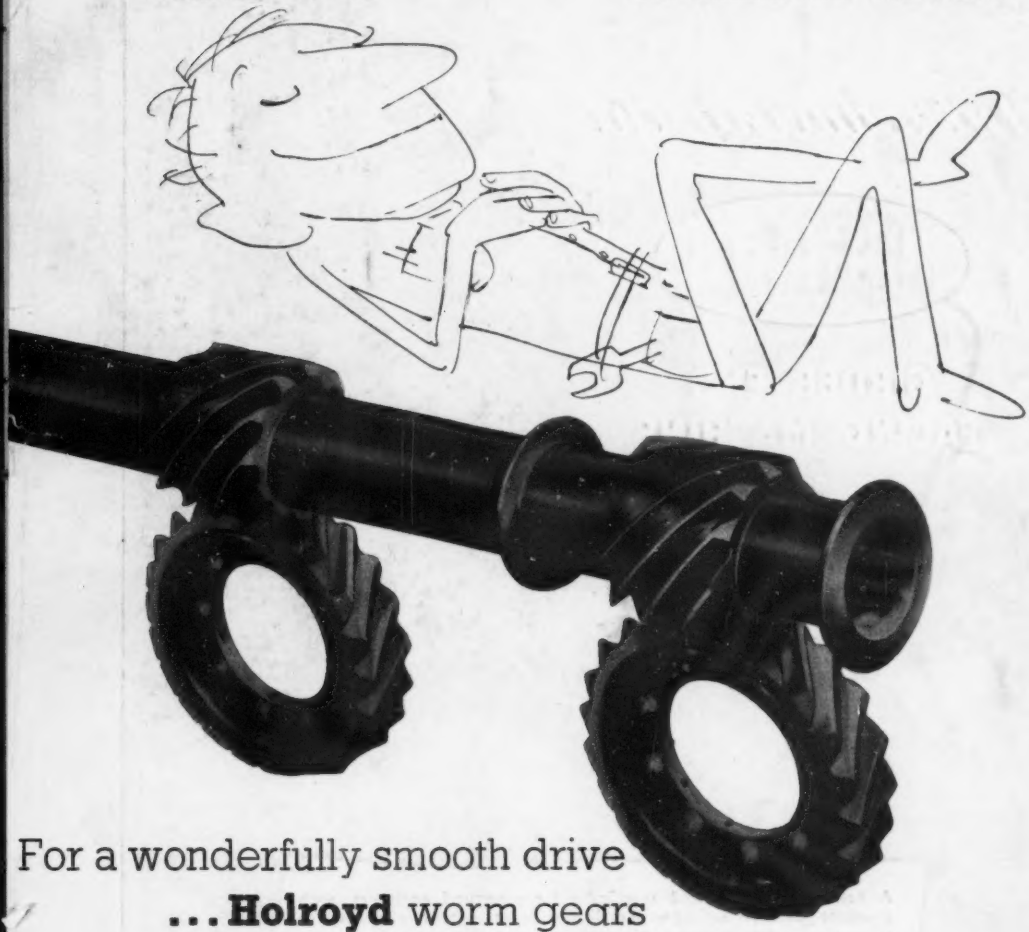
MACHINERY

NOVEMBER 19, 1958 ONE SHILLING AND THREEPENCE



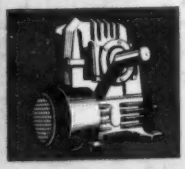
For a wonderfully smooth drive ...**Holroyd** worm gears

Did you know that all Holroyd worm gears are made in such a manner as to give some allowance for the inevitable deflection of bearings and gear housing? This results in an improvement in performance because the gears are then working correctly in the loaded position. We are able to do this by a technique of manufacture which gives precise control over the tooth marking.

In certain cases we go further than this and make the gears so that they have some latitude in assembly without impairing the efficiency. This is particularly valuable where the gears are difficult of access for adjustment during assembly.

Another point—Holroyd worm gears are made, if required, right down to 1/1 ratio as an everyday product—we have a special plant for such gears.

And don't forget that Holroyd worm gears around 1/1 or 2/1 ratio will carry several times the load which can be put through a pair of straight faced spiral gears of the same dimensions, and will work with an efficiency of the order of 97 per cent.



Have a word with **Holroyd**

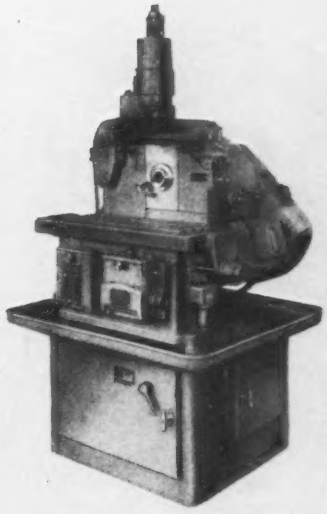
John Holroyd & Co. Ltd. Milnrow, Lancashire.

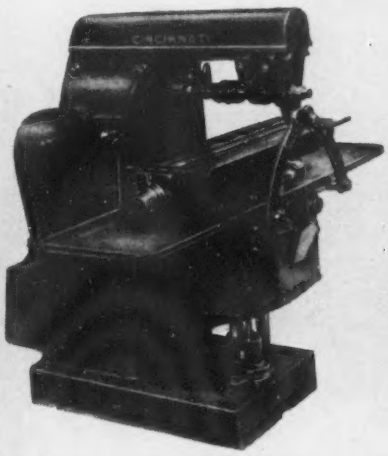
90 YEARS OF GEARS

PRODUCTION MILLERS
....Automatically
CINCINNATI

The 0-8 Plain Automatic Milling Machine—built by our Associates in Holland—is a milling machine capable of the highest rates of production. Available with power Rise and Fall spindle carriers, the Cincinnati 0-8 can perform over 350 different operating cycles.
Cycles changed in less than 60 seconds with pre-set cam cycle selectors. Whether singly or in batteries, the 0-8 Plain Auto. will increase your production.

✳ *Fully illustrated in catalogue M.1607.*





British-built 1-18 Plain Automatic Millers are proving their worth in metal-working plants throughout the world.
Extremely robust in construction, the 1-18 tackles small or large quantity production or both with equal dexterity. Like the 0-8, table cycles are initiated by movement of a single lever, and conventional and "climb-milling" operations are performed without any trouble with the built-in Automatic Backlash Eliminator.

Rugged—Reliable—Rewarding—the 1-18 Plain Auto. should be your choice automatically.

✳ *Specifications in catalogue M.1555-E.*

Write for catalogues and information to:—
CHARLES CHURCHILL & CO. LTD.,
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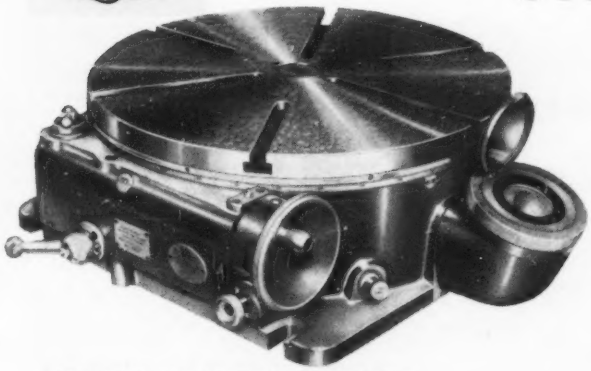
HIGH PRECISION CIRCULAR TABLES

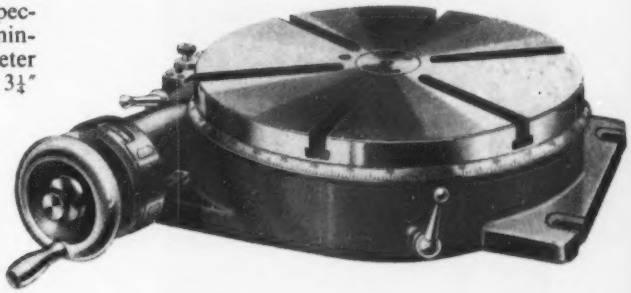


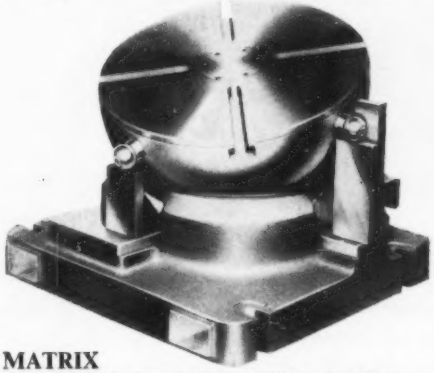
MATRIX 18″ OPTICAL CIRCULAR TABLE

With its highly accurate projection readings direct to 3 seconds of arc, this Table 18″ (450 m.m.) diameter is admirably suited for use on jig boring and similar machines where precision production is of paramount importance. It is also invaluable in the inspection department. Send for fully descriptive Catalogue Ref. O.C.T.

MATRIX 12″ CIRCULAR TABLE

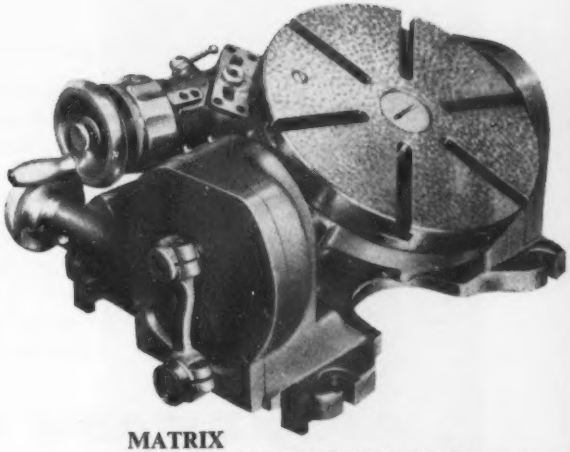
Designed for use on small jig boring machines and light milling machines as well as for inspection purposes. Table readings direct to one minute of arc and five seconds by vernier. Diameter of table 12″ (300 m.m.). Total overall height 3¼″ (80 m.m.). Send for Catalogue Ref. C.T.





MATRIX COMPOUND ANGLE SINE TABLE

The outstanding feature of this table is the substitution for the conventional hinged bearings at 90° of a hemisphere riding in a spherical seating and permitting any angle up to 45° to be set as a single or compound angle. Diameter of working surface 9″ (230 m.m.). It is accurate to within ten seconds of arc and can be used equally well for the inspection of jigs and gauges and for the manufacture of components. Send for Catalogue Ref. CAST.



MATRIX 8″ INCLINABLE CIRCULAR TABLE

This extremely compact 8″ (200 m.m.) diameter table has been designed for use on small jig boring machines, for light milling operations, and is an invaluable piece of inspection equipment. Angular inclinations read by means of built-in vernier to one minute of arc. Circular divisions to five seconds by vernier. Send for Catalogue Ref. I.C.T.

Coventry Gauge

& TOOL COMPANY LTD

P.O. BOX 39 COVENTRY GT. BRITAIN

Our customer produces Iron Pipe fittings. Normal tap life when machine tapping was only 40/50 components. A Technical Representative from Speedicut Works studied the problem and made recommendations on design and treatment which increased tap life on this operation to over 1,500 components.

Take advantage of the latest techniques in tool making—SPECIFY SPEEDICUT.

F. H. BROWN TOOLS LTD.
SPEEDICUT WORKS, CARLISLE STREET EAST,
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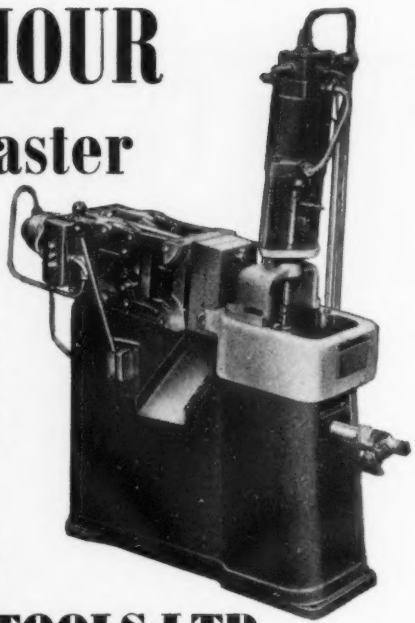
800 SHOTS AN HOUR

with the IMP/96 die caster



Depending on weight per shot, this air-operated impact die caster will make *up to 800 shots per hour*. Production is thereby increased and larger machines in the foundry made available for dealing with the bigger articles.

Moreover, castings have greater uniformity and precision — thanks to the new-type injection cylinder and air-operated die unit, which exert higher pressure on the molten metal. Production of the larger, heavier castings is accordingly simplified. The IMP/96 operates on a standard 80 p.s.i. airline and consumes as little as ·55 cu. ft. of free air per operating cycle. Write now for full details.

DIE CASTING SERVICE

We can supply larger castings up to a weight of 1¼ lbs. in Aluminium Alloy and 4 lbs. in Zinc Alloy. Send us *your* die casting problem! We also specialize in packaging, pressing, assemblies and spray painting.

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Tel: PAL 2271. Grams: Diemechs, Wood, London. Cables: Diemechs, London and at New York, N.Y., U.S.A., and Los Angeles, Calif, U.S.A.

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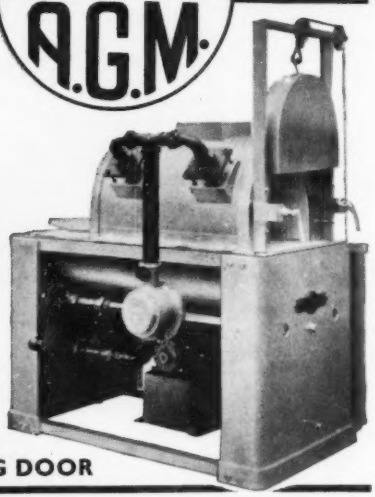
200 lb. REVERBERATORY FURNACE

500 lb. Capacity also available

A complete, self-contained unit for aluminium.



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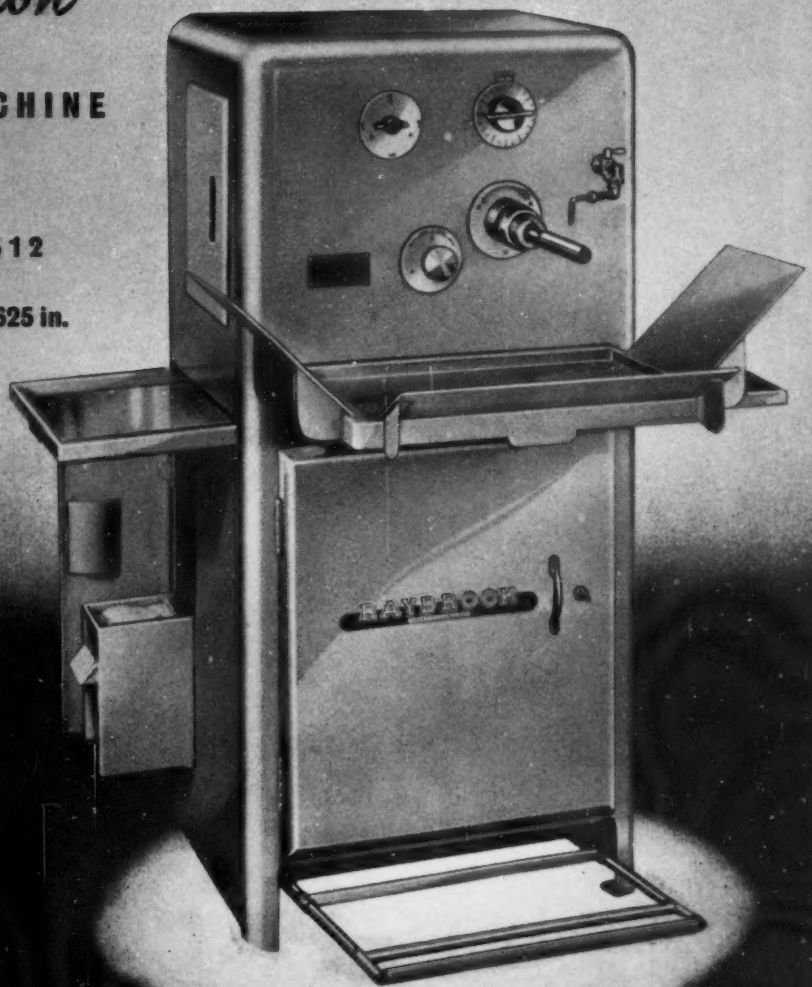
Precision

HONING MACHINE

MODEL 312
Capacity:
·120 in. to 2·625 in.



Note the storage for mandrels, stones, etc.

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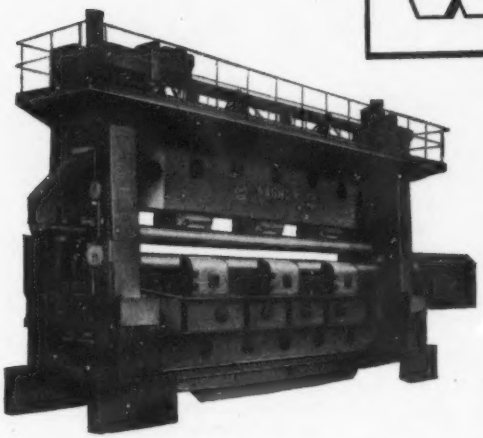

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with or without pre-bending.

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from 160 tons.

THREE-ROLL BENDING MACHINES
with or without pre-bending.

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for plates from $\frac{3}{64}$in. thick.

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for sections up to 16in. deep.

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for plates from $\frac{3}{64}$in. thick.

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for trimming both sides and slitting plates from $\frac{3}{64}$in. thick.

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also with planing attachment for plates $\frac{3}{64}$in. thick.

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with rack or screw drive, cutting power from 1·2 tons.

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from 160 tons.

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single and combined, from 160 tons.

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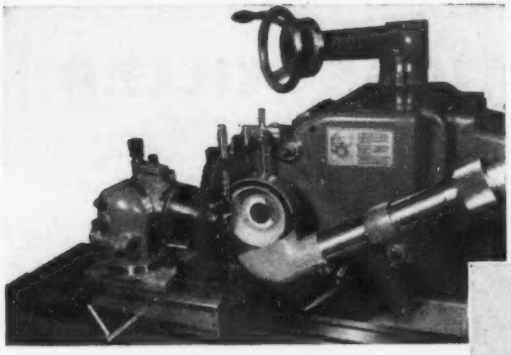
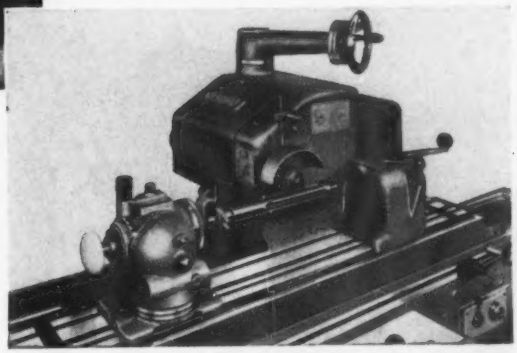
NRP



precision grinding with ---

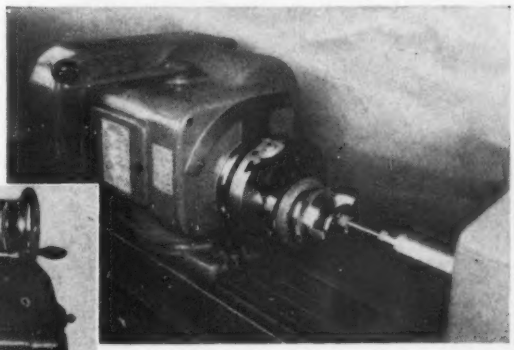


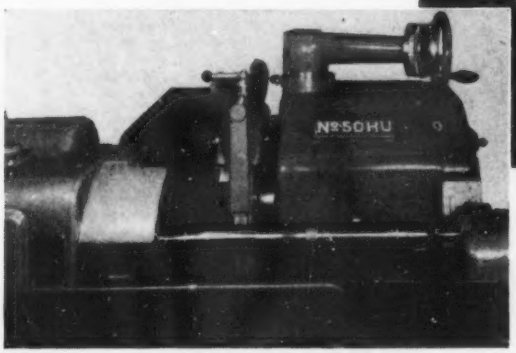
The ideal machine for* FACE, CYLINDRICAL, INTERNAL SURFACE, TOOL AND CUTTER *grinding.

--- KELLENBERGER
universal grinders

Features include adjustable table for taper grinding. Wheelhead and workhead with 360° swivel. Six rates of automatic table traverse. Automatic in-feed to wheelhead.

Three sizes 29½", 46½" and 59" between centres.





Kellenberger also offer a Tool and Cutter Grinder with 30$\frac{23}{32}$" or 36$\frac{7}{32}$" between centres.

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AD432

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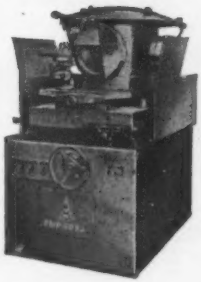
RANGE OF
GRINDERS

UNIVERSAL TOOL AND CUTTER GRINDER
Type M5 AR

These machines are precision made and an exceptionally comprehensive range of standard equipment is included in the very moderate price.
Special features are the ***Power Feed to Table*** and the equipment for ***Wet Grinding.***

BRIEF SPECIFICATION OF TYPE M6 A R.

Dia. of grinding wheels	8″
Working surface of table	32″ x 5″
Longitudinal movement of table	13½″
Cross movement of table	7½″
Min. height of grinding wheel over table	2″
Vertical movement of grinding wheel spindle	7″
Height of centres	5″
Max. distance between centres	20″
Motorised	400/3/50



ROTARY HEAD CARBIDE TOOL GRINDER
Type MO 14

Supplied with four grinding wheels mounted on rotary head, for roughing, sharpening, lapping and chip breaking in succession or for single operation of each wheel. Micro adjustment of tool holder, which accommodates all sizes and shapes of tools up to 2¾″ sq. section.

CARBIDE TOOL GRINDER
Type MO 13

Fitted with two wheels, one for sharpening and one for lapping. The various faces of the tool can be ground in succession without removing tool.

CARBIDE TOOL GRINDER
Type MO 15

With only one operating post. Fitted with two diamond wheels, one for sharpening, the other for lapping. Tools can be ground all faces without removing.

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FLOW REGULATORS

Martonair Flow Regulators are used extensively to control the speed of pneumatic cylinders. Normally fitted between the outlet port of the control valve and the cylinder, the regulator allows free flow into the cylinder but controls the flow to exhaust by orifice adjustment. The S.837 regulator illustrated here gives provision for in-line connection and is suitable for the speed control of cylinders up to 4" diameter bore. The taper for the adjusting needle has been specially designed to give not the usual wide parabolic flow curve but equal sensitivity of control at both large and small openings; each turn of the needle involves an increase of approximately 40% on flow and cylinder speed. Precise control can thus be obtained.

Send for leaflet B87 which gives full details of the Martonair S.837 Flow Regulator

MARTONAIR LTD · PARKSHOT · RICHMOND · SURREY

Telephone: RIC 2201 (6 lines)

AD.44

COLD HOBBING PRESSES

BY SACK & KIESSELBACH

Note depth measuring device, automatically stopping machine when required depth has been reached.

SACK & KIESSELBACH have for many years been building Cold Hobbing Presses. These machines are therefore not adaptations but are designed and built for this work only. Their sound, robust basic design, high quality workmanship plus several special features found only on these machines greatly facilitates the production of sound moulds. Further details on request.

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MACHINE TOOL CO. LTD.

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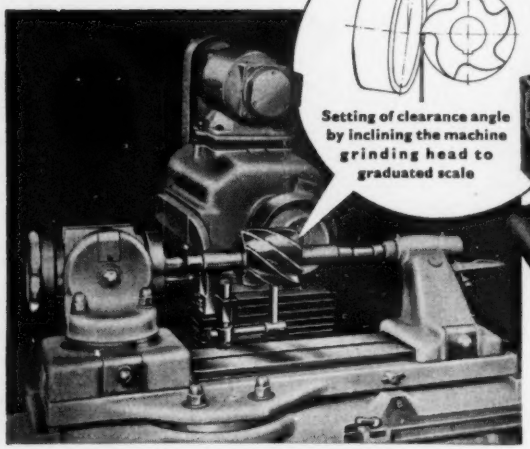
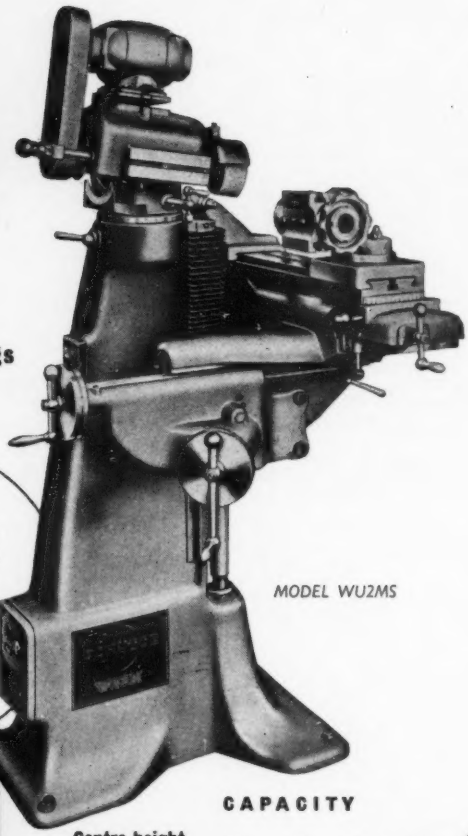
Grinding Spindle runs in Ball Bearings

Precision Ball Bearing Track Table

Sensitive Table Movement



Setting of clearance angle by inclining the machine grinding head to graduated scale



MODEL WU2MS

CAPACITY

Centre height	4½"
Grinding diameter	Max. 10"
Centre distance=grinding length	12½"
Helix angle adjustment (right and left hand)	60°-0°-60°
Clearance angle inclinability ...	12°-0°-12°
2 Grinding Spindle Speeds	appr. RPM 3000/6000

Write for detailed literature to:—

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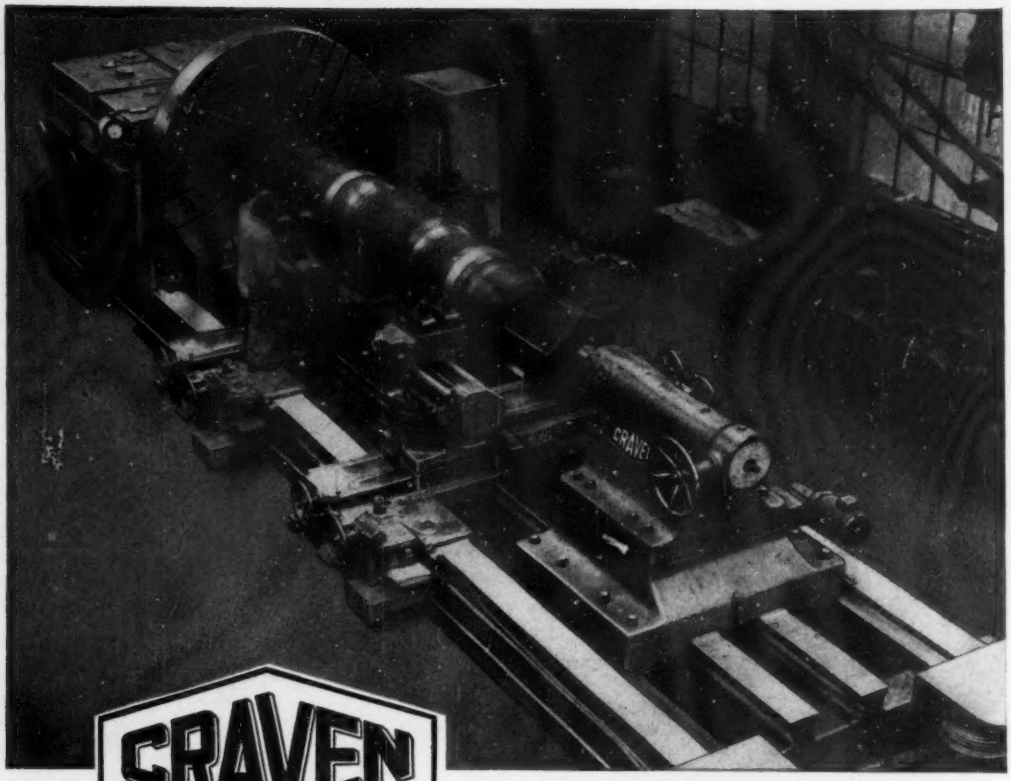
SCH5



48" Centres Sliding and Surfacing Crankshaft Lathe with interchangeable compound-type and lighthouse-type tool rests.

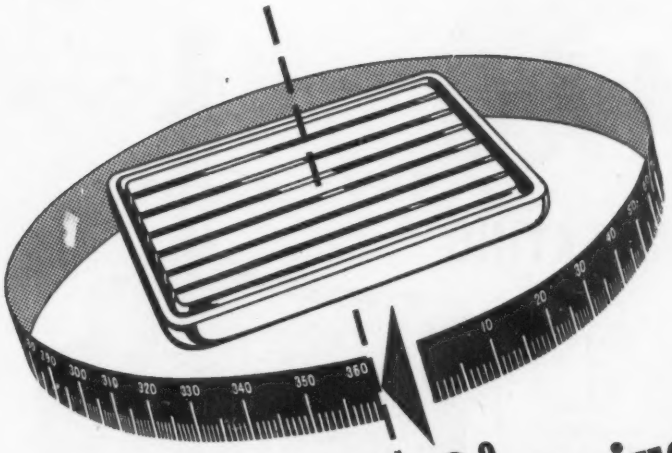
Heavy Duty Lathes for All Purposes

From 16in. to 100in. Height of Centres

There is a standard or special " Craven " Lathe for every large capacity or heavy duty turning requirement, a wide range of alternative arrangements being available to suit different classes of work. A speciality is made of heavy roll turning lathes and large diesel engine crankshaft lathes, whilst the " break " type of lathe construction is gaining popularity among marine engineers. The " Craven " range includes also high-speed tube boring machines and railway wheel and axle lathes of all types.

CRAVEN BROTHERS (MANCHESTER) LTD

VAUXHALL WORKS · REDDISH · STOCKPORT · ENG



360° Swivelling Table saves Setting Time and errors

SWISS

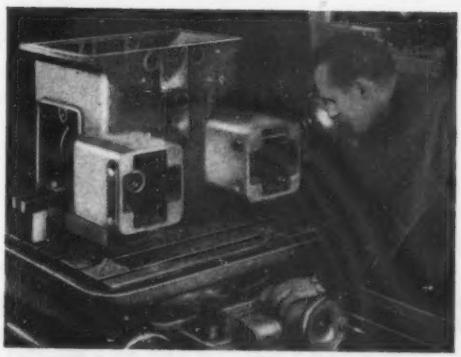
DIXI '60'

OPTICAL PRECISION JIG BORER

The table swivels through 360° with microscope setting to 1 min.—6 sec. can easily be estimated; the job can thus be swivelled right round and machined at any angle without disturbing the original setting. Other features include hydraulic control to the longitudinal and cross traverses, microscope setting to all traverses and additional 17½" precision optical table for mounting horizontally or vertically.

TABLE SIZE	28¾" x 32¾"
SPINDLE DIAMETER	2¾"
SPINDLE SPEEDS 34 TO 1400 R.P.M.	

Also DIXI '75', *a heavier machine with 3" spindle.*



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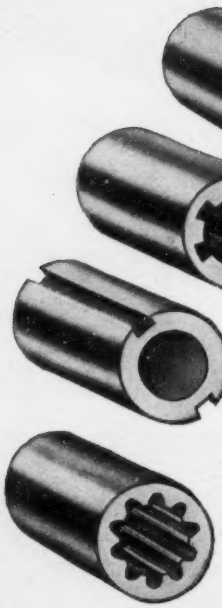
HYDRAULIC KEYSEATING MACHINES



Type	Keyway Width	Max. Stroke
KZ32	$\frac{1}{8}$" - $1\frac{1}{4}$"	$10\frac{1}{2}$"
KZ45	$\frac{1}{8}$" - $1\frac{3}{4}$"	$13\frac{3}{4}$"
KZ90	$\frac{1}{8}$" - $3\frac{1}{2}$"	$21\frac{1}{2}$" - 50"
KZ125	$\frac{7}{8}$" - 5"	59"

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PROPRIETORS **COMPANY** S. GUITERMAN & CO. Ltd

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Yate firm announces new projects

EXPANDED SCOPE AND SERVICE

West Country engineering firm opens London stockroom

Newman Industries Limited, of Yate, Bristol, have announced the opening of a new London stockroom. Situated in Monkton Street, Kennington, the building is within easy reach of Kennington and Lambeth North underground stations.

Eventually Newman will have on display at this stockroom, a representative range of the new machine tools for which they hold sole selling rights in the U.K. Meanwhile, several interesting machine tools will be moved to London, including a ROCCO horizontal borer (see adjoining column), and these may be inspected by arrangement.

The opening of this stockroom in the London area emphasises the rapid growth of the Newman Machine Tool Division over the last twelve months; in that time the Company has been granted sole selling rights in the U.K. for five continental manufacturers and achieved nationwide sales coverage through a team of skilled technical representatives. Anyone requiring fuller information should ring the Company's London Office, Sloane 8206.

REDUCED PRICES
See Overleaf

ROCCO FOR NEWMAN

The Italian machine tool manufacturers ROCCO have given sole selling rights in this country to Newman Industries Limited. Announcing this from his Yate Office, Mr. J. P. Hatfield, Manager, Machine Tool Sales, said that the ROCCO Horizontal Boring and Milling Machine, a big success at this year's Milan Fair, should prove just as popular in Britain. The first machine to be imported is the AL76 costing about £5,000, inclusive of import duty. The AL76 has an 18in. facing head, universal milling attachment and arbor support (also used for vertical milling). Other features are high precision scales, adjustable verniers and dial indicators for vertical and horizontal traverses. The machine will be fitted with screwcutting as standard. Maximum spindle speed is 1,500. Size of indexing table 48in. by 36in. Newman confidently expect ROCCO to find a ready market in this country.

STOP PRESS

MITCHELLS of Keighley have appointed Newman U.K. distributors for their range of centre lathes.

Complete Rebuilding Service

Some capacity is still available for machine tool rebuilding at Yate where over 40,000 square feet is set aside for this purpose. All machine tools are rebuilt to the appropriate Schlesinger limits and guaranteed for six months. A typical detailed planning sheet showing how each rebuild is planned down to the last nut and bolt may be obtained on application to Yate.

Heid lathe sold overnight

A HEID Neomat centre lathe, Model VK56, with variable centre heights, price in the region of £10,000, which was the main feature of the machine tool demonstration organised by Newman in Manchester last July, has been sold to a large engineering concern. This sale was completed in 24 hours; an executive saw the machine in operation at the Company's Yate showrooms and the order number was received next morning—**an excellent tribute to the performance of the machine.**

BETTER INFORMATION SERVICE

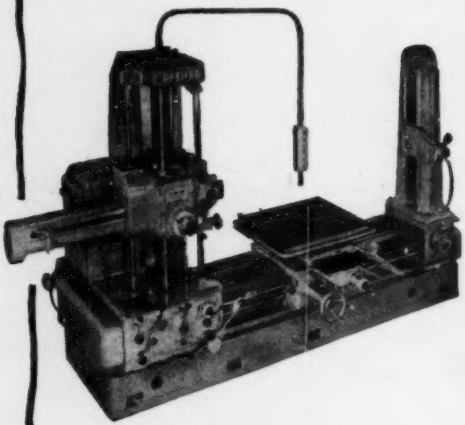
We all suffer from a morning mail stuffed with material which often bears little relation to our business. The latest move by Newman Industries Limited to reduce this irritation will be widely welcomed by Machine Tool buyers. The Company has sent out a prepaid card on which buyers can tick classifications of new and secondhand machinery in which they may be interested. The information collected will enable Newman to circularise details of tools and services more quickly and more selectively than was before possible. *Buyers in future will receive only literature dealing with the classifications in which they have shown interest.*

Companies who have not received a card and are interested can get one by writing to Newman at their head office *now.*

New lower prices

PFEIFER

We are now able to offer these two machines at considerably lower prices than was before possible.

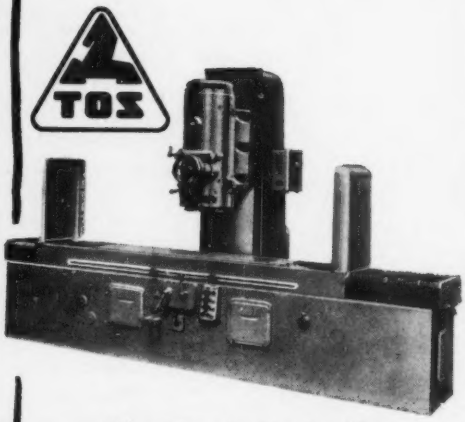


Horizontal BORING MACHINE

Suitable for long run repeat operations or short single set ups, this versatile boring machine is based on lathe design principles. The one piece well ribbed bed and heavily ribbed column ensure great rigidity. Outstanding precision is guaranteed by stringent tests with vibration instruments during manufacture.

The spindle head and traversing spindle are compact and vibration free. The gearing is hardened and ground; threads and nuts are ground for accurate adjustment and the spindle concentricity is accurate to within 0·00008 inches. Spindle size is 2¾in.

Type F60. Price £3,460.



Vertical Spindle SURFACE GRINDER

Available in a wide range for heavy duty precision or rough surface grinding of continuous or interrupted surfaces. During grinding the entire working width of the table can be covered simultaneously by the segmental grinding wheel. Flat and vee guides are pressure lubricated. The table is provided with slots for work clamping or the use of an electro magnetic chuck; the hydraulic traverse is infinitely variable and limited by adjustable stops. A dynamically balanced motor in the wheelhead drives the grinding spindle. The hydraulic rapid power traverse of the wheelhead is pushbutton controlled for each direction of movement and cut out travel limit switches are provided. The movement of the grinding wheel into cut is automatic and operated hydraulically or by hand at each reversal stroke of the table.

Working surface of table :

1ft. by 3ft. 4in.	**Price £1,750**
1ft. by 5ft.	**Price £1,935**
2ft. by 10ft.	**Price £4,615**

Sole Selling Agents U.K.

Newman

NEWMAN INDUSTRIES LIMITED

Machine Tool Division

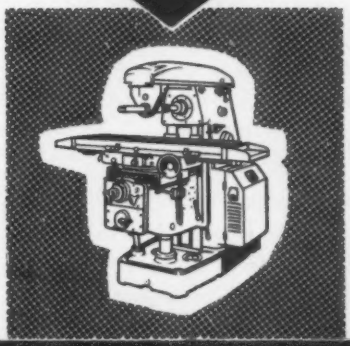
YATE • BRISTOL • ENGLAND

Telephone : CHIPPING SODBURY 3311 **Telegrams : "DYNAMO YATE"**

When answering advertisements kindly mention MACHINERY.

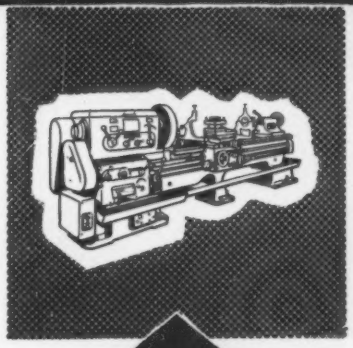
New single lever control

Technoimpex Universal and Vertical Milling Machines, Models UF and VF22 incorporate a unique foolproof single front lever which operates a range of twenty preselected dial speeds in geometrical progression from 19 to 1,500 r.p.m. The lever also controls the engagement of eighteen work table feeds in all directions, rapid power traverses, start, stop and instantaneous braking. The machine is specially designed for carbide tooling; the construction of knee and column ensure the greatest strength and rigidity under the highest loads.
On the vertical model the main spindle is driven by hardened bevel gears of 1:1 ratio. It can be swivelled through 45 deg. and vertical traverse is provided through pilot handwheel. The table surface of these machines is 60-in. by 15-in. **Price of the UF22 is £2,311, the VF22 is £2,505. Prices include motors and enclosed type panel control gear, coolant pump and standard accessories.**



» TECHNOIMPEX «

A wide range of standard extras worth over £700 is included in the price of the Model MVE Centre Lathe—complete electrics including 15 h.p. driving motor, complete motor driven suds unit; fixed and travelling steadies; four-jaw face plate, dog and chuck plates; two centres and a centre sleeve; change gears; micro sliding and surfacing stops; operators lamp.
Absolute vibration free running is ensured by helical gear and roller bearing spindle drive combined with well ribbed bed and rigid head construction.
The prismatic and flat bed guideways with removable gap piece are of maximum wear resistance. The headstock drive through a multi-disc reversible shock-free clutch transmits a range of 18 speeds, forward and reverse in geometrical progression of 12 to 950 r.p.m. through hardened and ground gearing on high tensile splined shafts.
Sizes of the machines are from 12in. by 40in. to 14in. by 120in. **Prices, including standard extras, range from £1,825 to £2,236.**



Sturdy and vibration free

Sole Selling Agents U.K. for Hungarian Heavy Machine Tools (TECHNOIMPEX)

Newman

NEWMAN INDUSTRIES LIMITED

Machine Tool Division

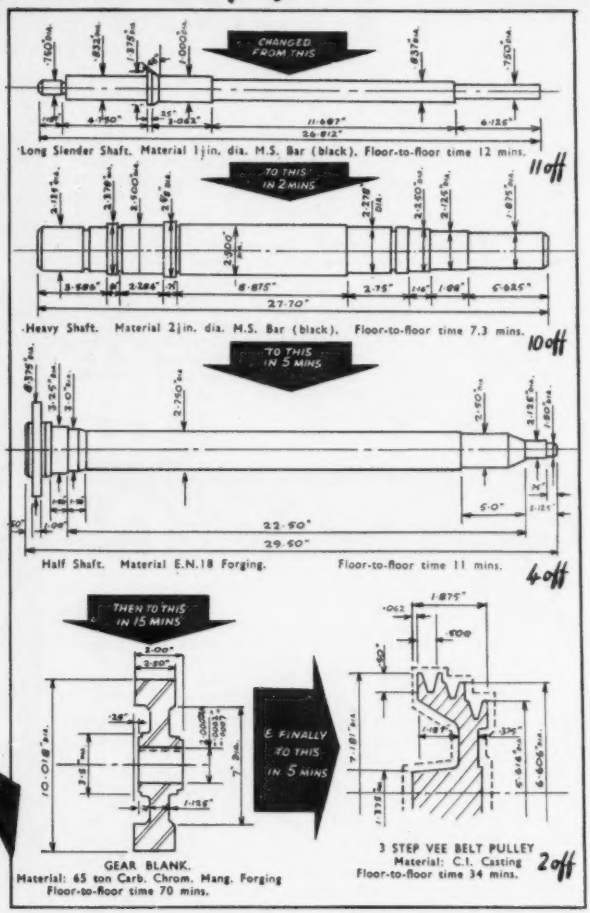
YATE • BRISTOL • ENGLAND

Telephone: Chipping Sodbury 3311 Telegrams: "DYNAMO YATE"

Advice on your copyturning problems

If you have any copying problems, get in touch with us. As exclusive HEID agents in the United Kingdom, we are able to prepare for you a detailed operation layout showing how HEID machines can tackle your problem and save anything up to 9/10 machining time.

Diagram showing actual floor to floor times achieved with a HEID "Sensitast" Lathe during ONE normal working day.



The HEID range, backed by over seventy years' experience in the manufacture of toolroom equipment, includes:—

★ COPYING LATHES with centre heights from 7½in. to 22¾in.

★ COPYING EQUIPMENT for use with planers, vertical borers, turning mills, horizontal milling machines.

★ REVERSING DRIVE UNITS suitable for any planers, shapers and slotters.

★ ELECTROMAGNETIC MULTI DISC CLUTCHES suitable for any power transmission.

Sole Selling Agents U.K.

NEWMAN INDUSTRIES LIMITED

Machine Tool Division

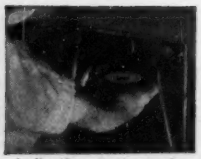
YATE BRISTOL ENGLAND

Telephone: Chipping Sodbury 3311 Telegrams: "DYNAMO YATE"

Branches at: London (Sloane 8206) Birmingham (Northern 9634) Manchester (Deansgate 2837,8) Glasgow (Central 2101/2)

When answering advertisements kindly mention MACHINERY.

Indicating r.p.m. of electric motor.



Indicating shaft speed, showing use of extension.

Indicating surface speed.

The Right REVS

Run your machinery at the optimum speed for peak efficiency. Any deviation from this speed almost certainly means that it—and you!—are running at a loss.

Cut this loss by making spot checks of r.p.m. with a SMITHS Hand Tachometer. Such a check can be made in an instant, even in unfavourable conditions. What's more, the reading is accurate to within ½%.

SMITHS HAND TACHOMETERS can be used for checking:—

Rotational speeds of shafts, spindles, gears, rotors and rolls.

Linear speeds in ft/min or metres/min of metal strips, textiles, paper, wire, plastic, film and conveyed material.

Surface speeds in ft/min or metres/min of cutting or grinding operations of machine tools, processing rolls, unwind rolls or wind up rolls for extrusion and strip production.

Readings can be taken in bad lighting conditions or where the dial is visually obscured.

AVAILABLE IN CHOICE OF FOUR MODELS:—

Model A.T.H. 4 (0-50,000 r.p.m.) Illustrated
Model A.T.H. 6 (0-10,000 r.p.m.)
Model A.T.H. 7 (0-20,000 r.p.m.)
Model A.T.H. 10 (0- 5,000 r.p.m.)

ALL FOR L.H. OR R.H. DIRECTION OF ROTATION

PRICE (complete with strong case and full range of accessories) **£14.14.0**
postage and packing extra.

POST THIS FOR FULL DETAILS

Please send full details of your HAND TACHOMETERS

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ADDRESS .....

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SMITHS INDUSTRIAL INSTRUMENT DIVISION

Chronos Works, North Circular Road, London, N.W.2. Telephone: GLAdstone 1136

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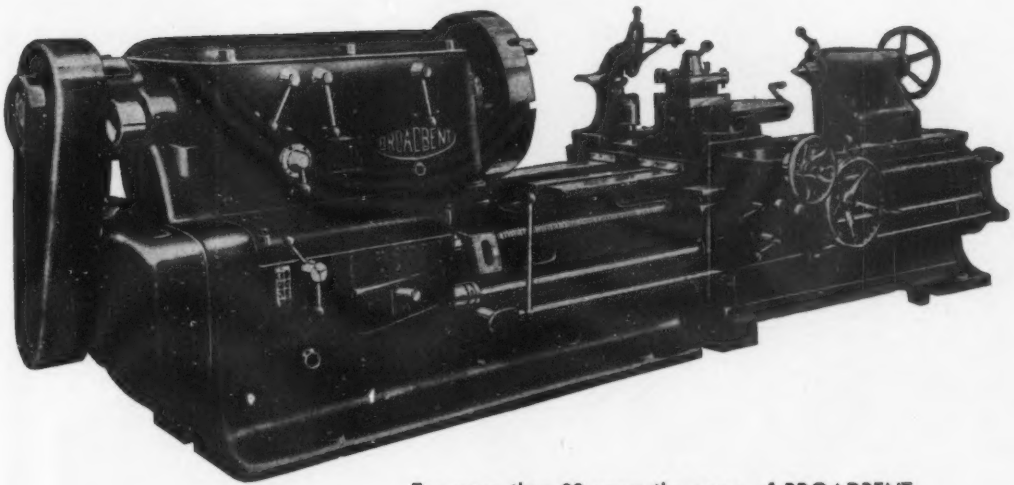
BROADBENT *Lathes*



For more than 80 years the name of BROADBENT has been synonymous with high quality centre lathes. The accumulated knowledge and experience of lathe manufacture gained during that time is reflected in the design and performance of present-day machines.

In addition to standard Centre Lathes from 8½" to 24" height of centres, we also specialise in Surfacing and Boring Lathes, Break Lathes, Heavy Duty Horizontal Plano-Milling Machines and Vertical Boring and Turning Mills.

8½" to 18" lathes can be offered with good delivery.

Write or telephone for full details.

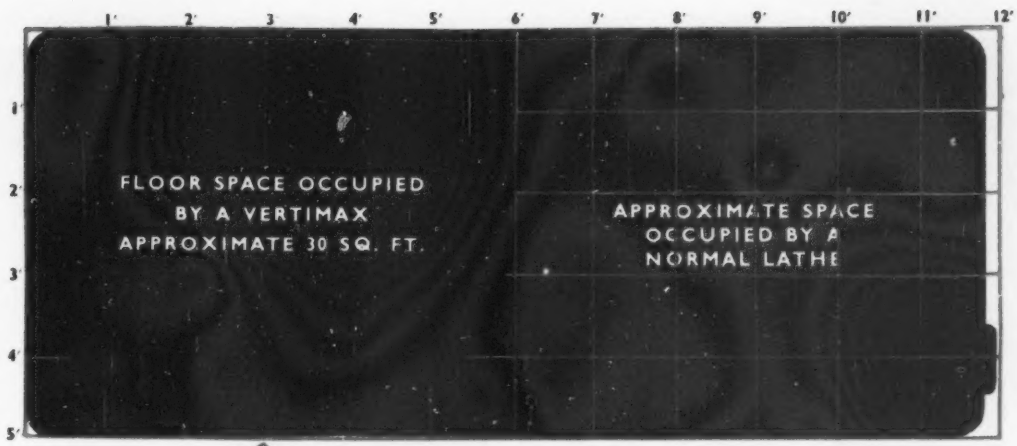
BROADBENT

HENRY BROADBENT LIMITED

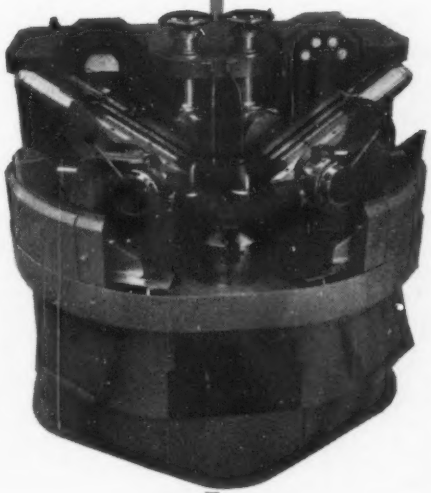
SOWERBY BRIDGE, YORKS. *Telephone:* HALIFAX 81331

A **Kerry** Company

BAS/HB/3



FOR PRODUCTION PER SQ. FT.



The VERTIMAX Vertical Spindle Production Lathe takes little floor space for the range and capacity of work of which it is capable. In fact it takes literally half the space of a comparable horizontal lathe. Also, its exterior is smooth and free from projections.

The VERTIMAX is extremely simple to set up and load. Its features include an air operated chuck and spindle brake, two independent and adjustable tool slides which can be swung through any angle, infinitely variable hydraulic feed, automatic operation and grouped controls.

For a brochure giving full details of the VERTIMAX production lathe, No. 2—21″ swing, No. 3a—24″ swing, No. 3—24″ swing, write to:—

CHARLES CHURCHILL AND COMPANY LIMITED

COVENTRY ROAD, SOUTH YARDLEY, BIRMINGHAM, 25.

BRANCHES : LONDON · GLASGOW · NEWCASTLE · MANCHESTER

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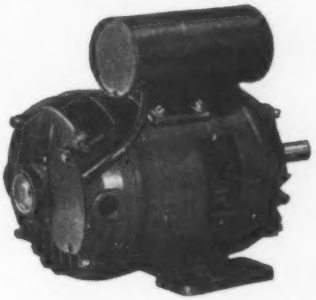
–but for fractional horse-power in industry...

the sturdy 'ENGLISH ELECTRIC' f.h.p. motors can be harnessed to do all manner of work efficiently and economically. From 1/20th horse-power upwards there is a model exactly suited to any particular load under any local conditions.

Details of the full range will be sent on request



'ENGLISH ELECTRIC'
f.h.p. motors

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2

F.H.P. Motors Department, Bradford

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

FHP. 39F7

Individually built to permit working to the closest tolerances, the Boxford 4½in. Precision Plain lathe has comparator gauges incorporated on the slides to maintain identical repeats. This is an exceptionally reliable and robust lathe.

Admits 17in. between centres. ¾ h.p. motor with infinitely variable speeds from 220 to 2000 r.p.m.

Special compound rest slide with fiducial indicators and slip gauge platforms supplied at extra cost or in lieu of standard rest.

Range of special equipment available

£340 . 0 . 0

BOX·FORD

4½in. PRECISION PLAIN LATHE

Send for fully detailed leaflet TODAY

DENFORDS ENGINEERING CO. LTD., HECKMONDWIKE YORKSHIRE

When answering advertisements kindly mention MACHINERY.

–but for fractional horse-power in industry...

the sturdy 'ENGLISH ELECTRIC' f.h.p. motors can be harnessed to do all manner of work efficiently and economically. From 1/20th horse-power upwards there is a model exactly suited to any particular load under any local conditions.

Details of the full range will be sent on request

'ENGLISH ELECTRIC' f.h.p. motors

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2

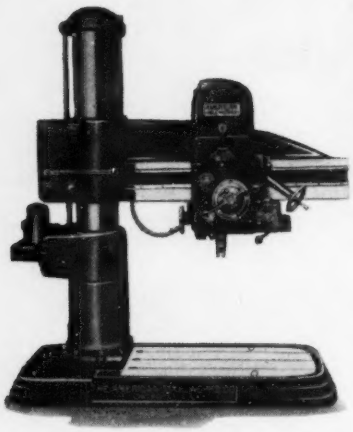
F.H.P. Motors Department, Bradford

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

FHP. 39F7

The radial with the **NITRIDED-STEEL SPINDLE AND SLEEVE**

The AMERICAN HOLE WIZARD



European built

The construction of spindle assembly is an outstanding achievement. The spindle is made of nitrided steel for extreme surface hardness—lap-ground for utmost precision. Spindle sleeve is also of nitrided steel, honed to size and mounted in precision Timken roller bearings.

- Twelve speed head with built-in motor drive with motor mounted on head and directly coupled to initial driving shaft.
- Electric Column Clamp operated from head.
- Combined Elevating and Arm Clamping mechanism through single lever control.
- Electrical reverse for tapping.
- Six Geared Feeds.
- Three Optional ranges of 12 direct reading spindle speeds.
- Nitrided spindle and spindle sleeve—anti-friction mounted.
- Lo-Hung Spindle Drive.

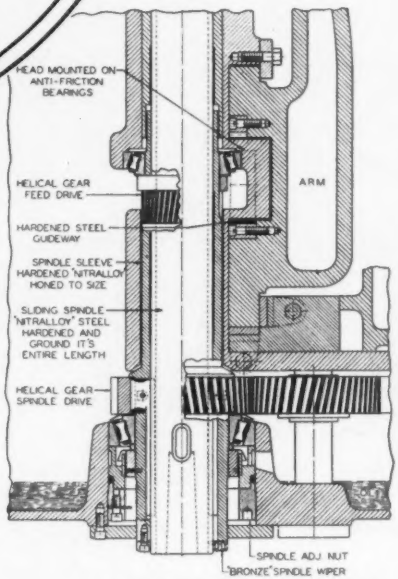


Diagram of spindle assembly.

Spindle unit showing integral feed rack, helical gear drive and adjustable Timken roller bearing mounting.

Sole Agents in the British Isles for American Tool Works.

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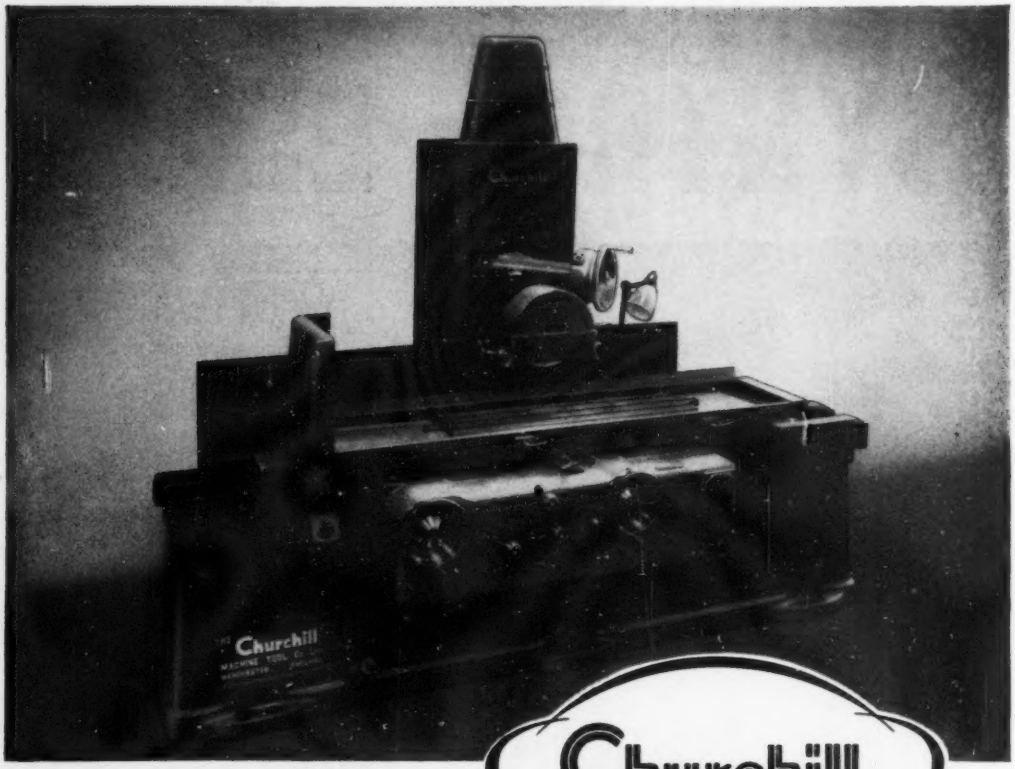

Churchill

'OSB'

HORIZONTAL SPINDLE SURFACE GRINDING MACHINE

This machine is designed for work requiring extremely accurate and highly finished flat surfaces. Besides being ideal for toolroom work and for die grinding, the Model 'OSB' can be used to advantage in the production line. High rates of output are obtainable. Built in three sizes with work tables 30in. by 10in., 42in. by 10in. and 60in. by 10in.

Easy and simple operation.
Built-in motor drive to grinding wheel spindle. Motorised automatic pump lubricating system and simple bearing assembly give a high precision spindle capable of heavy grinding cuts.
Variable hydraulic cross feed to wheel. Pre-set automatic cut-out and automatic reverse.
Fine and coarse vertical feed.
Massive cross slide underneath wheelhead column gives large area of support and maximum stability.
Hydraulic table traverse up to 90 feet per minute. Hand traverse interlocked with hydraulic control.
Permanently protected precision ground table slideways. Table traverse ways, wheelhead cross slideway and cross feed gears and bearings automatically lubricated from oil supply independent of hydraulic system.

THE CHURCHILL MACHINE TOOL CO. LTD. BROADHEATH, NR. MANCHESTER

Telephone: Altrincham 3262. *Telegrams:* Churchale, Manchester

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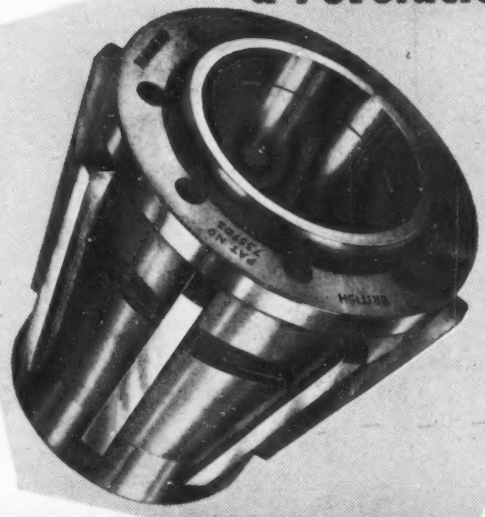
PRECISION *plus* PRODUCTION

C662

BURNERD PRECISION "multisize collet"

a revolutionary NEW workholder

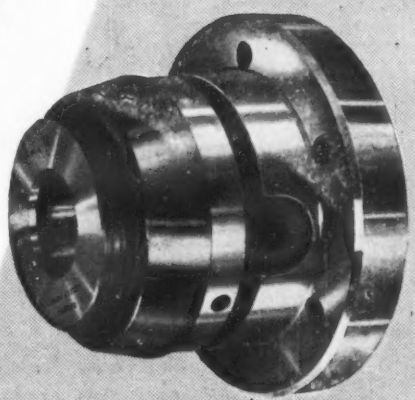


SUPERLATIVE ACCURACY · GRIP · RIGIDITY

TEN FEATURES OF THE COLLET

- Powerful grip—MANY TIMES GREATER THAN SPRING COLLETS.
- Greater accuracy than ever before achieved with collets.
- Grips and locates without distortion of collet.
- Each collet covers ⅛" range of capacity.
- Only eleven collets required to hold any diameter bar between ⅛" and 1½" whether English, metric or decimal sizes.
- Positive grip maintained under load.
- No difficulty with under and oversize components.
- Maximum feeds and speeds obtainable without risk of slipping and scoring or distortion of components.
- Constant parallel grip throughout complete range of collet.
- Thin walled components gripped firmly without damage.

This startling new workholder provides all the advantages of conventional spring collets combined with the flexibility of an adjustable jaw chuck. One "Multisize Collet" will replace at least 9 conventional collets and only 11 collets are required to cover a range of ⅛" to 1½". Several years of research and testing lie behind the "Multisize Collet" Write today for fully illustrated brochure.



THE NEW BURNERD COLLET CHUCK

Designed specifically for Burnerd "Multisize Collets", the new Burnerd Collet Chuck provides an extremely powerful and accurate closing mechanism for the Collets. Capacity ⅛" to 1½" diameter.

SAFELY FIRST

F. BURNERD & COMPANY LIMITED

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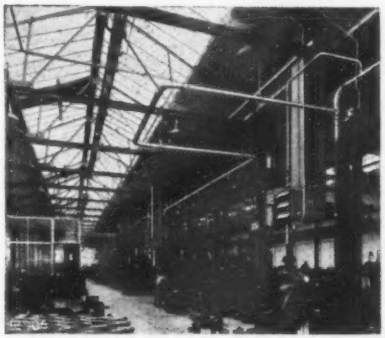
Is your heating system EFFECTIVE?

→ Is it ADEQUATE?

→ Is it ECONOMICAL?

Sturtevant Radiant Heating installation using standard plain, and curved panels.



A Sturtevant Unit Heating installation in a machine shop.

Sturtevant Heating Systems put heat where it should be—at working level, and give maximum results at economic overall cost.

STURTEVANT HEATING SYSTEMS INCLUDE :

- **Plenum Heating and Ventilation**
- **Direct Heating in combination with Tempered Air supply**
- **High Pressure Hot Water Heating**
- **Unit Heating**
- **Radiant Panel Heating**
- **Convector Heating**

Sturtevant engineers are experienced in all forms of heating and ventilation systems, and are always ready to design and install efficient plant to meet clients' requirements and site conditions.

For further particulars write to our reference MY 101Z.

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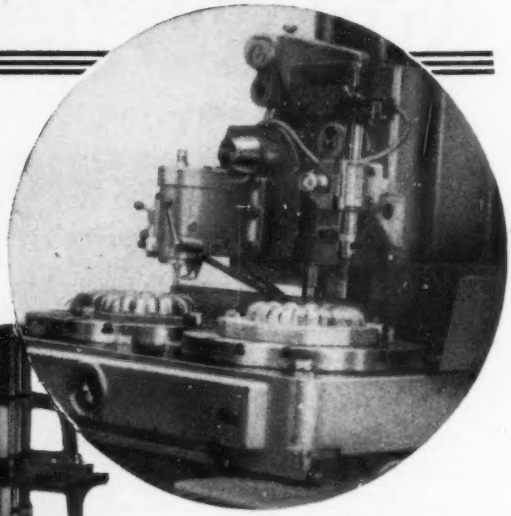
Automatic Die Sinker

for HORIZONTAL...
VERTICAL...
MIRROR...
CIRCULAR...
SEGMENT COPYING



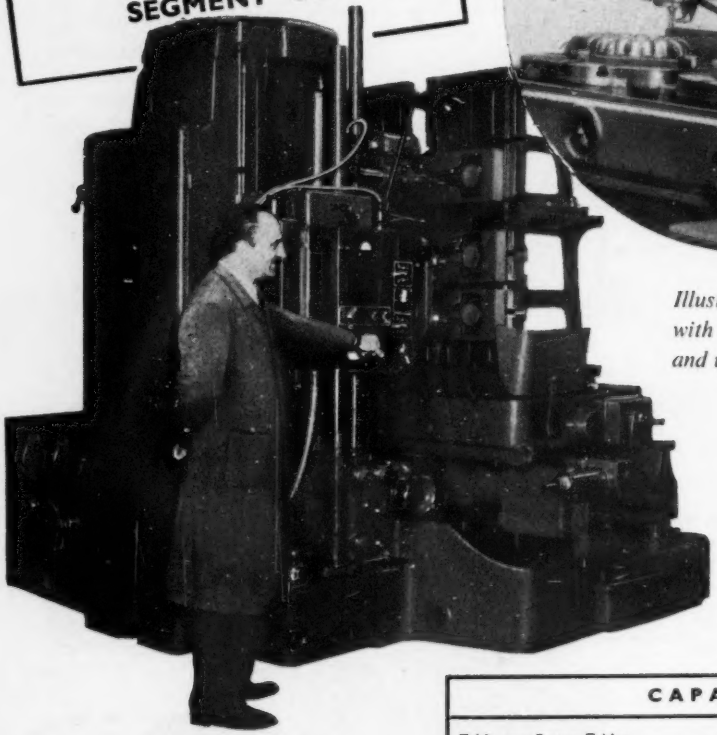


Illustration shows machine copying with vertical attachment fitted, and using the two rotary tables.

MODEL FK08c
TWO MILLING SPINDLES

Arranged with 2 angle plates for simultaneous reproduction of two components.

EARLY DELIVERY

EXCLUSIVE DISTRIBUTORS IN THE UNITED KINGDOM

CAPACITY	
Table, two Rotary Tables	27¼in. dia.
Longitudinal Table Traverse (automatic)	39⅜in.
Transverse movement of slide	15¾in.
Vertical travel of spindle head	31½in.
Spindle Speeds (8)	70 to 800 or 335 to 3,600 r.p.m.
Feeds (8)	
Longitudinal Table Feed (per min.)	11/16in. to 8⅜in.
Spindle Vertical Feed (per min.)	1/11in. to 5⅛in.
Net weight approx.	9¼ tons.

Send for comprehensive illustrated brochure

ELGAR MACHINE TOOL COMPANY LIMITED

RIGHT OPPOSITE NORTH ACTON STN.
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POWER FOLDING . . .

THESE NEW FOLDING MACHINES ARE FABRICATED FROM HEAVY STEEL PLATE, WELL RIBBED AND BRACED FOR STRENGTH AND RIGIDITY VIRTUALLY UNBREAKABLE! ALL CASTINGS CARRYING FRONT FOLDING BEAM AND TOP BEAM OF HIGH GRADE STEEL.

Will handle a wide range of intricate operations with extreme accuracy. Provision for TRUE RADIUS BENDS and NARROW RETURN BENDING.

ALL STEEL construction *Unbreakable*

The New Besco Production *All Steel* Motorised FOLDING MACHINE

(Made in 5 sizes)

Graduated scales ensure quick and accurate setting, and adjustable back gauges cover repetition work. Drive from reversing motor gives a smooth, equal lift. Gears and drive enclosed under bed of machine. Operated from a floor-mounted remote control panel with "stop", "start" and "reverse" push-buttons. Magnetic brake ensures positive control. Fitted with replaceable bronze bearings.

Model No.	M.614	M.814	M.612	M.812	M.1016
Max. length	73 inches	97 inches	73 inches	97 inches	121 inches
Max. thickness	14 gauge	14 gauge	12 gauge	12 gauge	16 gauge
Min. flange	1in.	1in.	1in.	1in.	1in.
Max. radius	1in.	1in.	1in.	1in.	1in.
Adiustment to folding centre and beam ...	1in.	1in.	1in.	1in.	1in.

Note.—Folding Machines for hand operation are available from 3ft. to 10ft. capacity.

DESIGNED AND BUILT BY . . .

F.J. Edwards Ltd

Edwards House, 359-361, Euston Rd., London, N.W.1
Telephones: EUSton 4681 (7 lines), 3771 (4 lines).
Telegrams: Bescotools, Norwest, London.

Lansdowne House, 41, Water Street, Birmingham, 3
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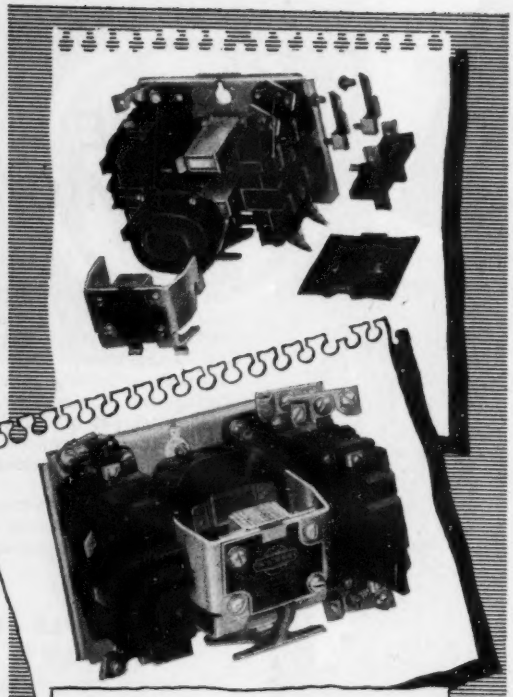

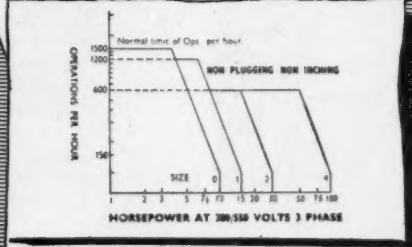

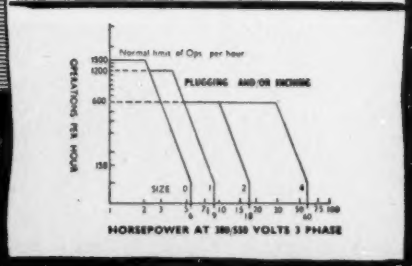

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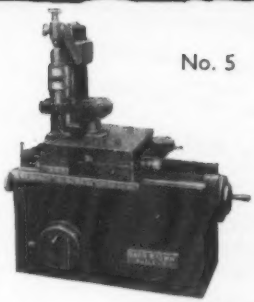

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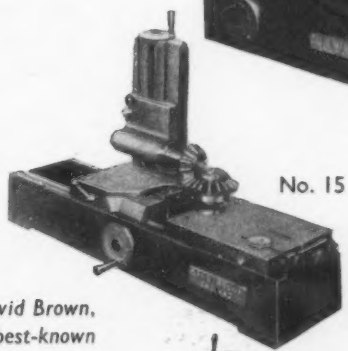

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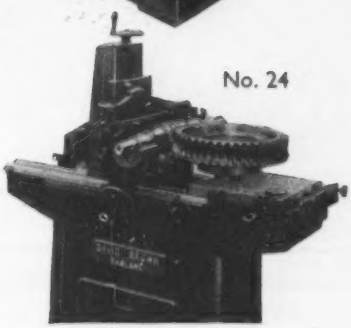

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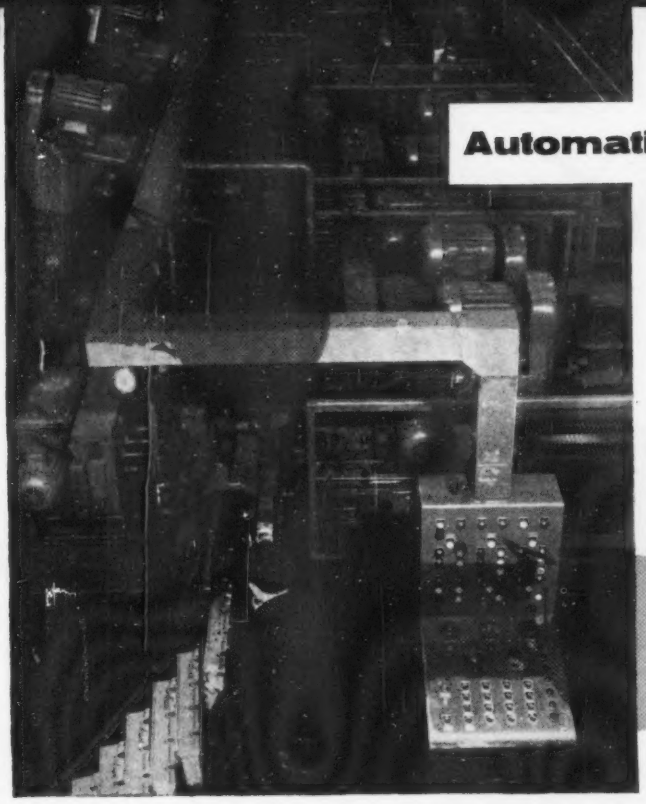

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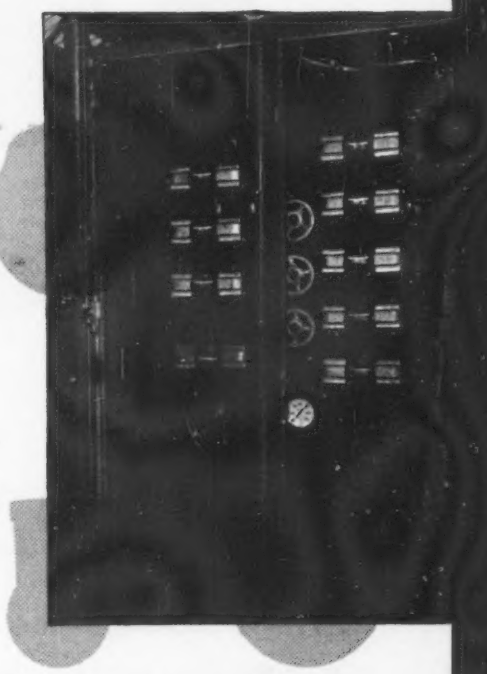

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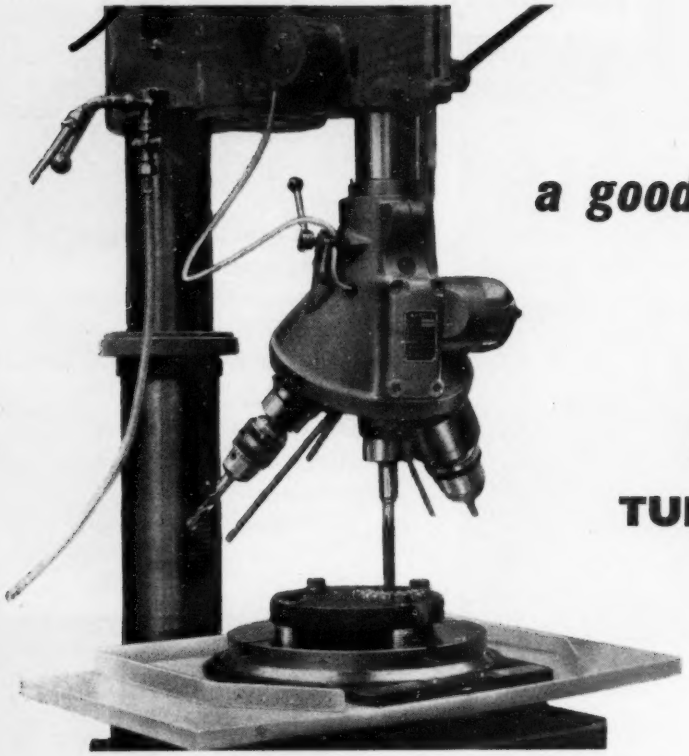

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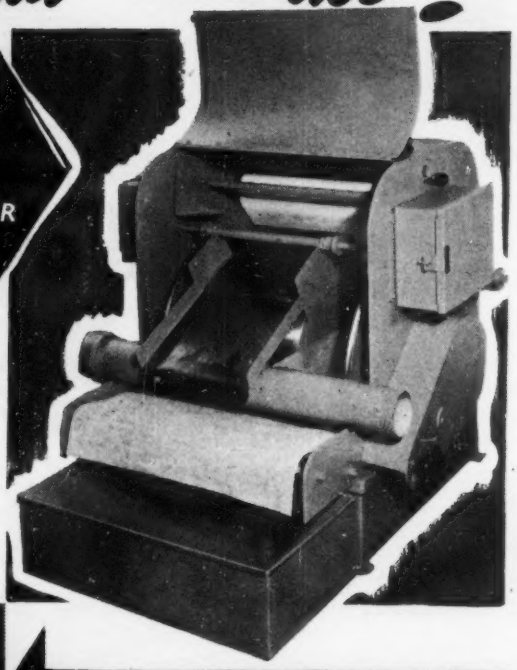

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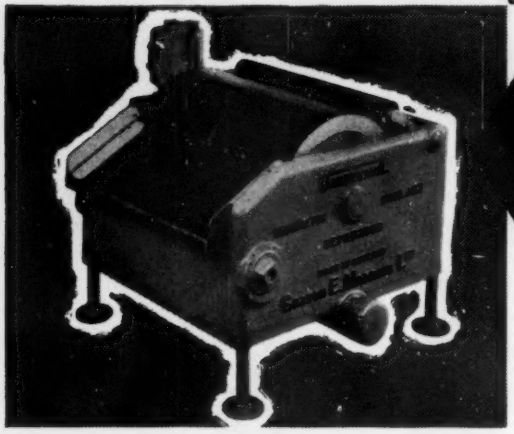

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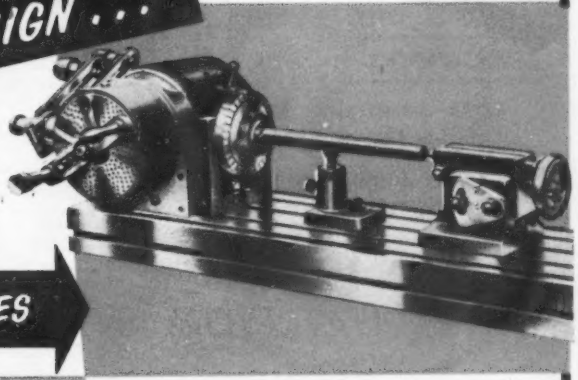

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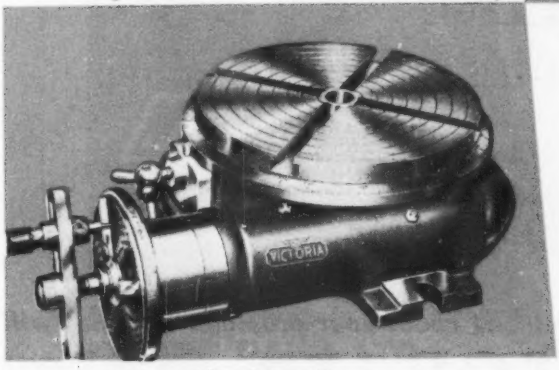

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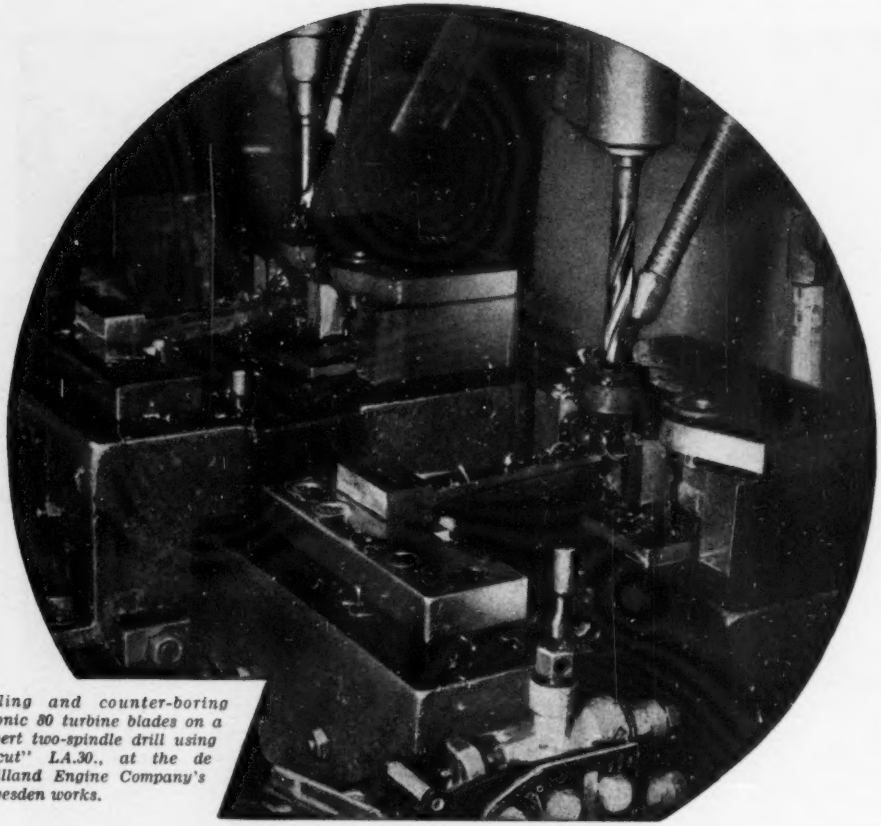

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CONTENTS

Abstracts of Principal Articles

Production of Cash Registers and Accounting Machines ..... P. 1156

In this third article concerned with production methods employed by the National Cash Register Co. (Mfg.), Ltd., Dundee, the application of large Natco multi-spindle machines for drilling, reaming and counterboring operations on frame castings is described, and reference is made to the printing of number wheels by the rotary offset and screen methods. Precision grinding plays an important part in the production of many components, and particulars are given of typical operations on Jones & Shipman, Churchill, and Jones & Lamson machines. Reference is made to the company's inspection procedures, and the policy which has been adopted for the scheduled maintenance of plant is described. (MACHINERY, 93—19/11/58.)

Typical Operations on Rocket Components ..... P. 1169

Large numbers of liquid- and solid-propellant rockets are produced by the Aerojet-General Corporation, U.S.A., and in this connection it has been necessary to overcome many manufacturing problems. Various techniques which have been developed cannot be described for reasons of security. Among the representative operations here discussed may be mentioned the copy turning of an aluminium nozzle ; the drilling of deep holes in a stainless steel injector plate; the drilling of 4,000 small diameter holes in an injector head on a machine provided with a special indexing arrangement; and the copy-milling of propellant cavities in injector plates. These cavities are of two different forms, and two masters, mounted on an indexing table, can be brought into use, as required. (MACHINERY, 93—19/11/58.)

Multifactor Type 22 Automatic Rotary Transfer machine ..... P. 1173

The Swiss-built Multifactor type 22 rotary transfer machine can be supplied with different numbers of work-holding fixtures and horizontal- and vertical-spindle cutter heads for handling a variety of small and medium-size components. Feed motions are applied by hydraulic cylinders which are incorporated in the cutter heads and supplied with fluid by other cylinders operated by cams. Right-angle drive attachments, to take side and face milling cutters, are available for mounting on the vertical spindle heads, to which power feeds can be applied downwards and horizontally. (MACHINERY, 93—19/11/58.)

Italian Machine Tool Exhibition, Milan P. 1177

Some 530 firms, occupying stands covering a floor area of about 270,000 sq. ft., participated in the first exhibition organized by the Italian Machine Tool Builders Association (Unione Costruttori Italiani Macchine Utensili), and held in Milan from September 12 to 21. The majority of the equipment demonstrated was of Italian manufacture but there was a representative selection of other Continental, British and American machine tools. Reference is made in this article to Zocca cylindrical and surface grinding machines, Maxnovo hydraulic copying lathes, Mannaioni high-speed threading lathe, Rigiva milling machines, and a Federici combined ultrasonic and spark-erosion machining unit. (MACHINERY, 93—19/11/58.)

New Techniques for Grinding Sintered Carbides ..... P. 1186

Encouraging results have been obtained from experiments with two new techniques for grinding sintered carbide materials, such as those employed for cutting tools. It has been found that by raising the temperature of the tool to between 750 and 850 deg. C. prior to grinding, and maintaining it at this temperature during the operation, these materials can be ground satisfactorily and rapidly with standard corundum or silicon carbide wheels, and with a complete absence of craze-cracking. This method is particularly intended for rough grinding, where large amounts of stock must be removed as, for instance, when reclaiming a badly damaged tool. Finish grinding is carried out by an electrolytic method, with a metal-bonded corundum wheel. Iron powder is used as the binder, and is sintered with the abrasive in ratios from 1 : 1 to 1 : 3, by weight. (MACHINERY, 93—19/11/58.)

Dawson Universal Milling Arbor...P. 1194

Edward Dawson (Engineers), Ltd., Church Avenue, Sawley, Near Long Eaton, Nottingham, have recently introduced a universal milling arbor, known as the Uni-Arbor, which is suitable for use on all machines incorporating any of the standard spindle nose tapers. Cutters ranging from $\frac{1}{16}$-in. diameter to large face cutters can readily be set up on a " base-arbor " by the use of interchangeable " inserts," either individually, or in various combinations. Similarly, cutter-gangs can be set up or removed from the machine as self-contained units, by the use of a special cutter-arbor for horizontal milling machines. Boring bars, designed for mounting in a similar manner, are also available. Some typical simple and " compound " cutter set-ups are described and illustrated. (MACHINERY, 93—19/11/58.)

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If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

IN FORTHCOMING ISSUES

Producing the Vauxhall Victor—Combined research to improve performance on multi-spindle automatics.

A Surplus of Steel

Additions to productive capacity have enabled outputs of pig-iron and crude steel to be substantially increased during recent years to meet a steadily rising demand. For the period from 1951 to 1957, progress in this field was uninterrupted and it may be noted that the weekly average output of pig-iron advanced from 186,000 tons in 1951 to 225,000 tons in 1954, and 275,000 tons in 1957. For crude steel the corresponding figures were 301,000, 356,000, and 417,000 tons respectively. Despite the considerable growth in production, quite substantial imports were necessary during the period to help to satisfy the needs of industry and, even so, various users were frequently hampered because they could not readily obtain adequate supplies. It was noteworthy, too, that the imports fluctuated considerably in accordance with the prevailing relationships between home supplies and demand. Under the heading "pig-iron and sponge iron," for example, imports rose from 301,000 tons in 1951 to 732,000 tons in 1952, fell to 339,000 tons in 1954, increased again to 673,000 in 1955, and by 1957 had dropped to 320,000 tons.

When imports of "iron and steel" in various forms are considered collectively the figures are even more striking, but in this connection it must be borne in mind that imports at various stages during the period may have been stimulated by lack of processing capacity for certain forms of material rather than by absolute shortage of steel. The tonnage under this heading for 1951 was 883,000, for 1952, 2,457,000, for 1954, 764,000, for 1955, 2,318,000, and for 1957, 1,285,000. Since much of this material was partially or fully processed, the value of these imports was necessarily high and for 1954 the total was £125 million, and for 1956, £106 million. For purposes of comparison it may be noted that in 1952 exports of "iron and steel" were valued at £192 million, and in 1956 at £173 million.

This year there has been a drastic change in the situation. During the first quarter the output of pig-iron fell slightly, as compared with the 1957 average, to 271,000 tons per week. For the second quarter the average was about 251,000 tons, and for the third quarter 226,000 tons. Over the nine months the weekly average was thus about 249,000 tons, and in relation to the average for the full year 1957 this represented a reduction of output of more than a million tons. Output of crude steel continued the upward trend during the first quarter, and the weekly average for the period was approximately 429,000 tons. In the second quarter, however, the average fell to 389,000 tons, and in the third quarter to 327,000 tons. During the nine months, therefore, the average figure was 382,000, and without making any allowance for the further increases in productive capacity that have taken place, there was a loss over the period, in comparison with the full-year average for 1957, of some 1,365,000 tons.

Imports of "iron and steel" from January to September amounted to 641,000, valued at £40 million, as against 989,000 tons, valued at £59 million in the corresponding period of 1957. At the same time there was a fall in exports for the nine months from 2,375,000 tons, valued at £159 million, in 1957 to 2,004,000 tons, valued at £138 million this year. It will be apparent, therefore, that the declines in imports and exports approximately balanced in both tonnage and value. Consequently, the reduction in output must be attributed almost entirely to lessened demand from industry at home, despite the very high level of activity that has prevailed in certain branches.

Iron and steel have become such vital factors in both the internal and external trade of the country—the consumption of steel per head of population may reasonably be regarded as a measure of the standard of living—that we can ill afford to allow productive capacity to lie idle. As has been indicated, there have been frequent shortages in recent years which have adversely affected the consuming industries, and it is not unreasonable to suppose that when the general expansion of manufacturing activity is resumed, there might be a rapid transformation from abundance to dearth. In the circumstances it might be argued that there would be considerable justification, from the national standpoint, for building up substantial stocks, particularly in view of the durable nature of these commodities. At present day costs, however, individual producers cannot be expected to hold stocks beyond certain limited levels. According to the figures contained in the Monthly Digest of Statistics, stocks of pig-iron at steel works, steel foundries and blast furnaces rose from 1,039,000 tons at the end of 1957 to 1,152,000 at the end of September, and this latter total represented only about five weeks' production at the rate then prevailing. Similarly, there have been only very modest increases this year in the stocks of crude and semi-finished steel, according to the latest figures presented.

Production of Cash Registers and Accounting Machines

Methods Employed by the National Cash Register Co. (Manufacturing), Ltd., Dundee

In articles already published in MACHINERY, 93/692—24/9/58, and 93/804—8/10/58, concerned with manufacturing techniques developed by the National Cash Register Co. (Manufacturing), Ltd., Dundee, some interesting set-ups have been described for the production of shaft components, deburring and barrel finishing, broaching, riveting, cam and profile milling, hardening and brazing, and high-speed milling, also applications of a number of special-purpose automatic machines for drilling and reaming. Attention has been drawn to the very large number of different components that must be handled in batch quantities of widely varying size, the adding machine seen in the heading illustration, for example, containing a total of some 4,300 parts. This aspect has necessitated careful consideration in the development of methods which ensure efficient production, with economic tool costs, and permit rapid changing of set-ups. Other production methods are here described, and some details are given of the company's policies with regard to component inspection and preventive maintenance in the machine shops.

MACHINING FRAME CASTINGS

The various milling, drilling, reaming, and tapping operations required on cast-iron bases and frame components for accounting and adding machines, and cash registers, are carried out in a section, specially equipped for the purpose, adjacent to the main assembly line in the Camperdown factory. This arrangement has been adopted to facilitate the movement of work, particularly the larger castings used in accounting machines, also to keep these somewhat dirty operations on cast iron away from the main machine shop on the nearby Industrial Estate.

Of particular interest in this department are three American-built Natco multi-spindle hydraulic-feed drilling machines, two of which, shown in Fig. 1, are connected by jig guide rails and are used for carrying out drilling and reaming operations on the base castings for the Class 31 accounting machines.

A close-up view of the workpiece loaded into the jig is given in Fig. 2. Drilling operations are first performed on the machine at the left, and the jig, which is mounted on rollers, is then moved, by hand, along the square-section guide bars *A*, Fig. 1, to the second machine, where certain holes are reamed or counterbored. The workpiece is held in the jig by a series of hand clamps, and the drills, reamers, or counterbores are guided in a bush plate, as at *B* Fig. 2, which slides on four guide pillars on the spindle head and is located at the working position by two large-diameter dowels *C*, on the jig.

Fig. 1. Arrangement of the two large Natco multi-spindle machines, connected by jig guide rails, employed for drilling, reaming, and counterboring operations on cast-iron frames

A total of 95 holes is drilled in this accounting machine base, and the operation is carried out in two stages, on batches of work, with interchangeable multi-spindle heads. No coolant is employed, and standard high-speed steel reamers are used. The cycle time for the first stage is 6 min., and for the second stage 6½ min. Limits of ±0·001 in. are specified for hole centres, and +0·001 −0 for the diameters of reamed holes.

Another large Natco multi-spindle machine, of similar design, is installed for operations on right- and left-hand cast-iron side frames, which are handled separately, with interchangeable spindle heads. The jig on this machine is arranged to index transversely, to four drilling positions, to produce the required hole pattern, and safety switches are fitted which prevent the drilling cycle being started unless the jig is correctly located.

Milling machines installed in this department include Cincinnati duplex and single-spindle production types, and very satisfactory results are also obtained with Pratt & Whitney, Asquith, and Morey machines, normally designed for 1 to 1 ratio profile milling from a template, under hand control. After removal of the stylus pins, these machines can be readily used for rapid light-duty milling operations on the numerous bosses and facings provided on the types of castings handled. Tungsten-carbide tipped cutters are extensively employed for these operations. Single-spindle pillar drilling machines, arranged in multiples up to six, are installed for drilling, reaming, tapping, and counterboring operations on the smaller types of castings, which are held in box-type jigs.

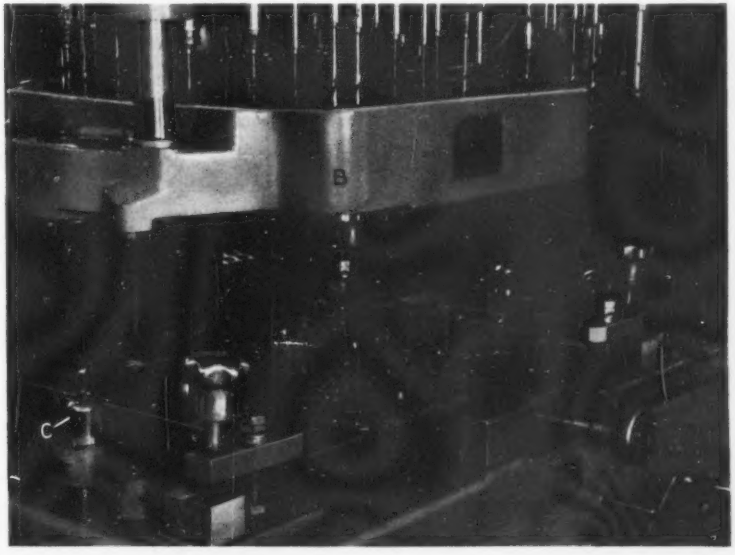


Fig. 2. Close-up view of the jig, with a casting in position, on the Natco multi-spindle drilling machine

OPERATIONS ON NUMBER WHEELS

Shown at *D* and *E* in Fig. 3, are two examples of number wheels, or indicators, used in National

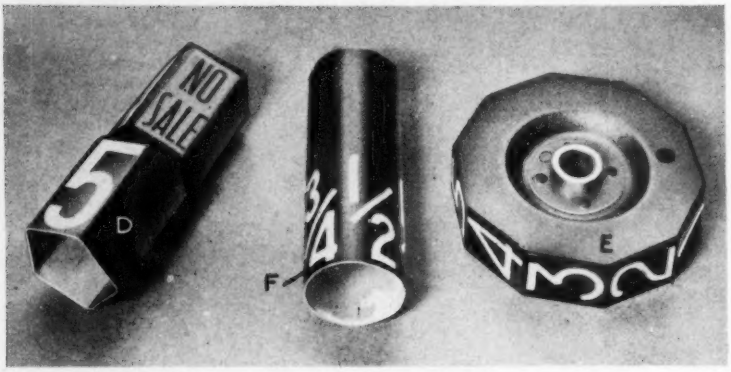


Fig. 3. Typical printed number indicators incorporated in National cash registers are shown at *D* and *E*

cash registers, the part *E*, comprising a multi-sided pressing of 0·016-in. thick aluminium, to which is riveted a flanged centre boss. The component at *D* is produced from aluminium tube of approximately 1¼ in. diameter by 0·016-in. wall thickness, and the numbers are marked on the periphery, as shown at *F*, before the staggered flats are formed at the ends. The part shown has five flats, and there are similar numbered components with six staggered flats at the ends.

Round tubes for the part *D* are first given a white surface on a Dawson, Payne & Elliott roller-coating machine. The numerals and letters are then produced by offset printing on the Dawson, Payne & Elliott offset printing machine shown in Fig. 4, which was specially designed for this type of work. It is capable of printing in four colours, if required, and is also used in the manufacture of collapsible tubes, for example. The workpiece is loaded on to a mandrel at station *G* of a 3-station indexing carrier, and is removed at station *H*, after it has been printed by contact with the ink band on the continuously rotating disc *K*.

Staggered flats are produced on the printed tube by means of the air-operated tool shown in Fig. 5. This tool incorporates a centre mandrel, on which the workpiece is loaded, as seen at *L*, and pushed up to a rear stop within the head *M*. The tube is a loose fit on the mandrel, and the flats are formed by the stretching action applied by two sets of staggered, radial blades, as at *N*, which are moved outwards by an air cylinder at the rear. The required blending of the flats at the centre of the tube is effected by blades carried in the head *M*, which are moved radially inwards, to bear on the periphery of the tube, by means of an air cylinder *P*.

Numbers in white on the periphery of the component *E*, Fig. 3, are produced by the screen printing method, on a dark brown background, which is applied first by spraying. The latter operation is carried out in the adjacent paint finishing shop with the portable unit seen in Fig. 6, which is wheeled into position in a Bullows waterwash spray booth. The workpieces, as seen at *R* and *S*, are loaded on to mandrels, which are supported by outer tailstocks and coupled to a

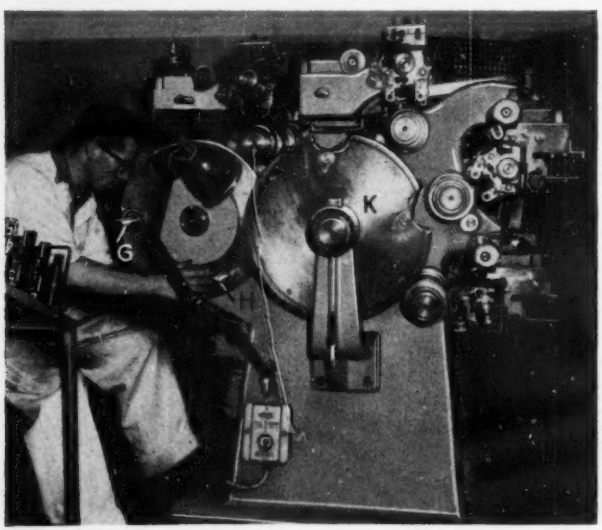


Fig. 4. Dawson, Payne & Elliott offset printing machine for cash register number indicators

driving head *T*, at the centre, whereby they are rotated continuously at a slow speed.

The driving motor also rotates a screw *V*, provided with combined right- and left-hand threads of coarse pitch which are engaged by a round pin projecting from the underside of a carriage *W*. The latter moves along two round guide bars and carries a standard spray gun, which is held by a clamping arm. Mounted on a flat bar *X*, pivoted at the left-hand end, are two cam plates *Y* and *Z*, which control the opening and closing of the spray gun valve. Spraying is carried out at two passes, from right to left, and back, and the carriage motion is reversed automatically at the left-hand end by the action of the threads on the screw. When the gun has returned to the starting position, the operator switches off the driving motor and releases a latch on the right, which allows the pivoted bar *X* to retract under spring pressure, and the spray gun valve to close. The gun is started by pulling the bar forward into engagement with the latch, and during the carriage traverse the valve is closed by the cam plates as the gun traverses past the centre driving bracket for the mandrels.

Stoving is carried out with the workpieces clamped on the mandrels, which are handled in groups of four, mounted in a special holder. Equipment in the finishing shop includes two Ballard conveyorized stoving ovens, as shown in Fig. 7, for handling work with smooth and wrinkle finishes. In this connection, it may be noted that glass fibre is now being employed for certain covers and panel components, particularly for accounting and adding machines, with the object of reducing noise in operation.

Fig. 8 shows a bench-mounted automatic machine which has been designed and built by the company for screen printing, in white, the numbers on some 20 different components of the type seen at *E* in Fig. 3. A stainless steel screen, of 400 mesh is employed, which enables a heavier coating of paint to be applied than would be possible with a normal silk screen, and has longer life.

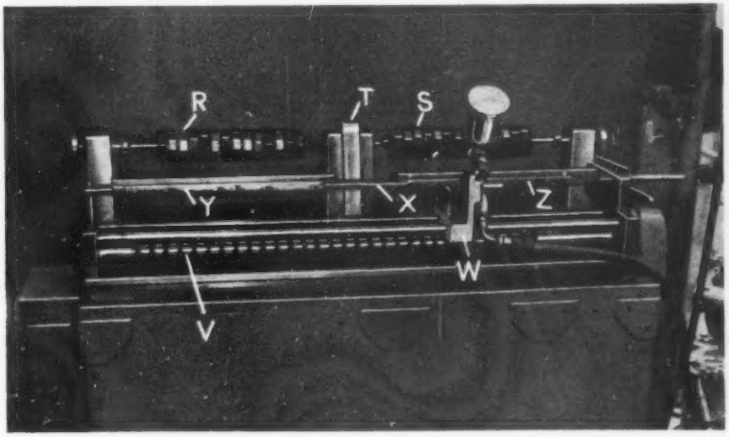


Fig. 6. Automatic spray painting unit for applying the undercoat to cash register number indicators

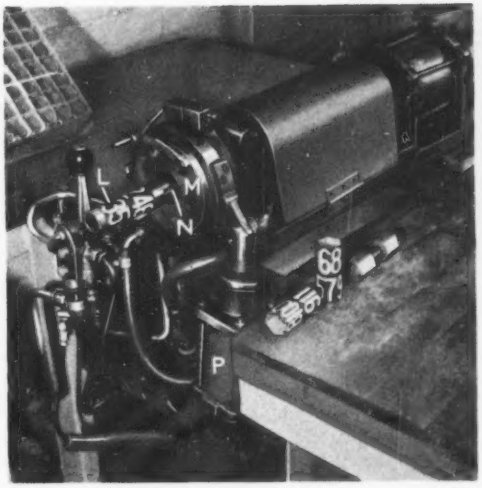


Fig. 5. Air-operated bench machine employed for forming the staggered flats on each end of number indicators of the type seen at *D* in Fig. 3

A component is located on an indexing spindle at *A*, immediately below the screen, to the top surface of which paint is applied periodically. The screen is retained in a frame *B*, pivoted along its rear edge on a roller carriage *C*, which is indexed automatically from right to left along guide rails *D*. This indexing motion takes place in unison with the rotary indexing of the work spindle, to bring the numbers formed by the mask on the screen into position, in turn, over the workpiece flats. It is effected by a ratchet mechanism driven by a motorized variable-speed unit at *E*, the ratchet

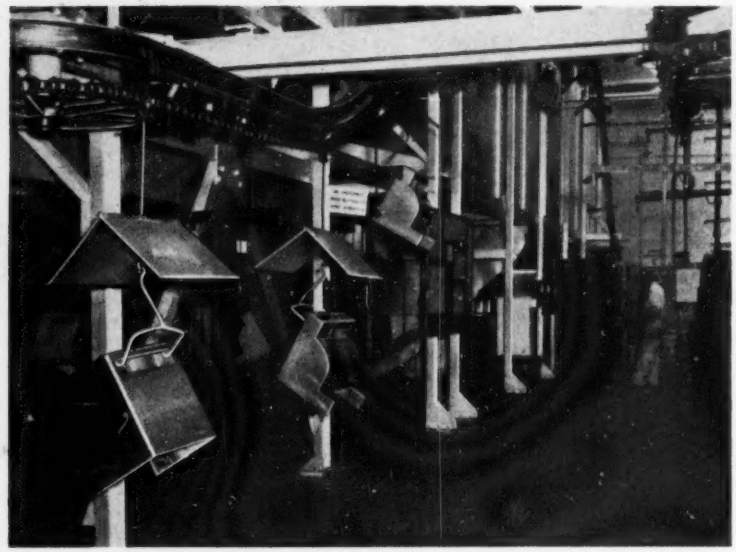


Fig. 7. A view of one of the Ballard conveyor stoving ovens in the paint finishing shop

wheel being attached to a pinion on the work spindle, which meshes with a rack secured to the carriage.

When the screen and workpiece have been indexed, the number is marked by the action of a rubber roller which is carried on a spring-loaded, pivoted arm in a reciprocating holder, and bears on the top of the screen and the work. The holder is actuated independently, by a link, from the driving unit, and moves in a guideway on the machine frame. An outboard support roller on the arm bears on the top edge of the frame. Upon the completion of a forward and a backward stroke, the pivoted frame *B*, together with the roller, is raised clear of the work by means of a cable *F*, coupled to a link on the driving unit. Indexing of the screen carriage and work then takes place, and the screen is lowered again in preparation for the next stroke. When the printing operation has been completed, the machine is stopped by means of a trip switch, with the screen raised, and a detent is released to allow the carriage to return to the starting position under the action of a weight suspended from a wire cable *G*. On this machine, 120 number wheels can be marked per hour.

PRECISION GRINDING OPERATIONS

Grinding plays an important part in the production of many components on which close limits must be maintained, and in the well-equipped section devoted to this work the machines installed include Churchill Fulcro-Sizer and Jones & Shipman cylindrical grinders; Snow and Jones & Shipman No. 540 surface grinders; a Cincinnati centreless grinder fitted with a Feedmatic hopper unit for handling a variety of shaft components; an

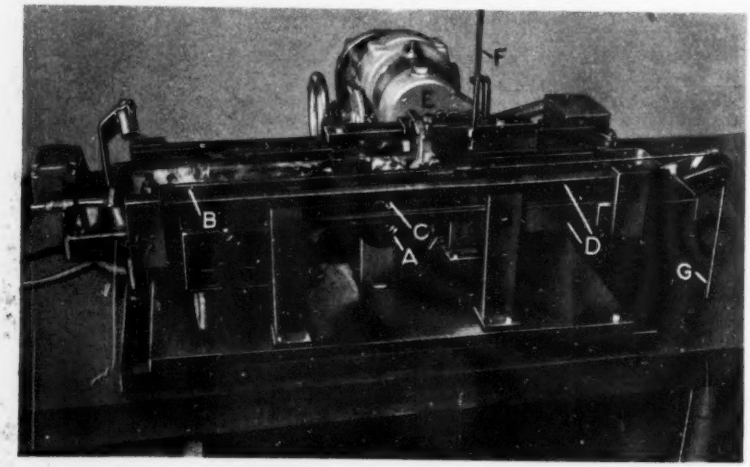


Fig. 8. This semi-automatic machine was developed by the company for screen printing number indicators

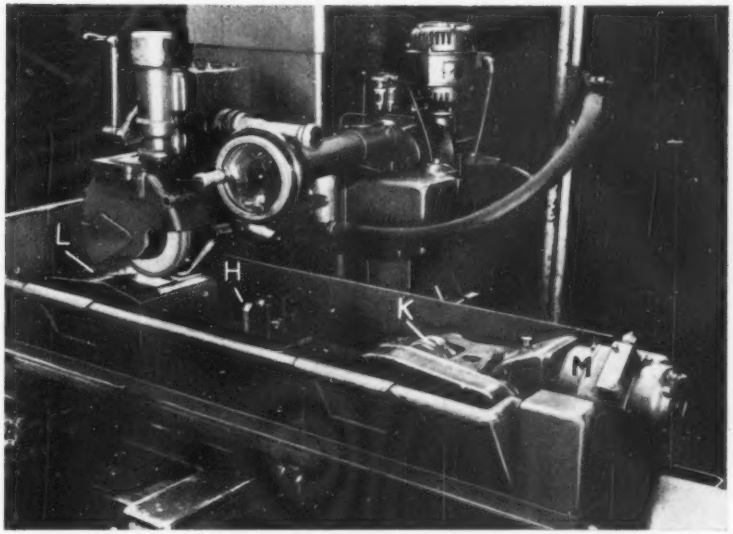


Fig. 9. Jones & Shipman Fig. 1012 surface grinder equipped for form grinding by the crushed wheel method

American-built Jones & Lamson thread grinder; and two Jones & Shipman Fig. 1012 surface grinders with wheel crushing equipment, for operations on profiled parts. In this grinding section, Philips coolant clarifiers are extensively employed to ensure a high standard of surface finish on the work.

On the Jones & Shipman formed-wheel surface grinders some 16 different parts are handled, and one of these machines is seen in Fig. 9 set up for carrying out a form grinding operation on the 0·505 and 0·030 in. radii on the latch plate shown in Fig. 10, which is incorporated in the National Class 21 cash register. This component is produced on a press from 0·080-in. thick cold-rolled mild steel, and after blanking and piercing, the entire outline is shaved, leaving sufficient material on the 0·505, 0·030, and 1·031 in. radii to permit them to be finished by grinding. The shaved blanks are copper plated to provide for local hardening at a later stage, and the 1·031 in. radius is then ground on a Churchill cylindrical grinder, with the parts located by the ½ in. bore, and clamped six at a time on a mandrel.

For the form grinding operation on the Jones & Shipman machine, Fig. 9, the blanks are held, six at a time, on the fixture *H*, by means of a clamp bar tightened by a hand nut, and location is provided by two pins which enter the ½-in. and ⅝-in. diameter holes. Approximately 0·005 in. is removed from the form, using a Carborundum AA.220.L5 wheel, and the output is 85 pieces per hour.

The parts are next carburized, hardened, and inspected, and a hub and a stud component are then flush riveted in to form the assembly shown in Fig. 11. After the assembly operations, the face of the hub is surface ground on one of the Snow machines, and the 1·031-in. radius is finished to 1·028 ±0·0004 in. on a Jones & Shipman cylindrical grinder, four workpieces being handled at a time. Finally, the previously ground latch radii Fig. 10, are finish form ground to 0·500 in. and 0·025 in. using the same set-up on the Jones & Shipman machine, Fig. 9, but with the parts located, two at a time, by the hub bore and the stud at a separate station on the right of the fixture.

In Fig. 9, the working crushing roll, which is used periodically for forming the grinding wheel, is seen at *K*. It is carried in a unit on the right of the machine table, and rotates idly when the wheel is being crushed. An idly-rotating master

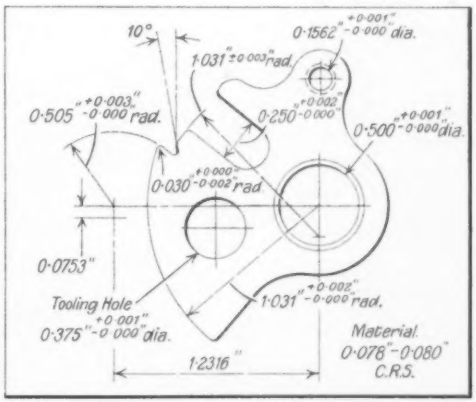


Fig. 10. The steel latch plate here shown is form ground on the Jones & Shipman machine seen in Fig. 9

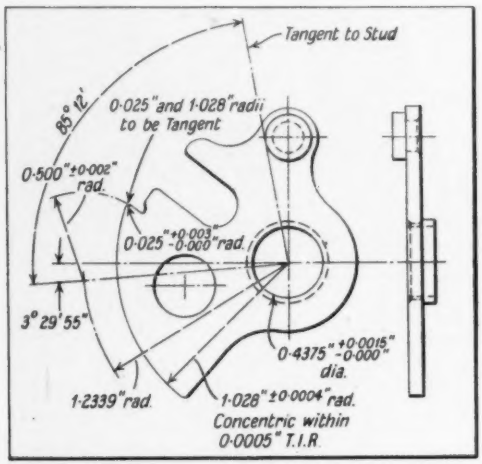


Fig. 11. The latch plate after assembly of the centre hub and the stud

roll is provided in the housing *L*, at the opposite end of the table, and is employed to crush the wheel accurately to form in preparation for re-grinding the work roll when the latter becomes worn. For this operation, the working roll is driven at a suitable slow speed by the motor at *M*.

Another component, known as an aligning bar, which is handled in appreciable quantities and requires to be form ground, is shown in Fig. 12. It is incorporated in the National Class 31 accounting machine and is made from ⅝-in. wide by 0·108-in. thick nitriding steel strip. Pieces, 10·925 in. long, are first sawn off on a Cincinnati 1/18 milling machine, and after the burrs have been removed from the ends, using an abrasive band machine, one hole of 0·125 in. diameter is pierced for jig location purposes. Next, the bars are straightened by serration planishing in a Bliss 400-ton press, and they are then hardened and tempered to produce a toughened core. Scale resulting from the heat treatment is removed by Roto-Finish barrel finishing, with the parts loaded in layers.

Following another straightening operation, one side face of the bar is surface ground on a Snow machine to reduce the stock thickness to 0·088 in., and straightening is again carried out. The five 0·130-in. wide slots are next pierced on a Rhodes No. 3, 75-ton geared press, and are deburred in a Kerry sensitive drilling machine, using a standard ½ in. rosebit reamer. Before the opposite face of the bar is surface ground to produce the finished thickness of 0·080 in., a straightening operation is performed, and, after face grinding, the bottom edge is ground square, to produce a width of 0·535/0·537 in. The sharp edges are removed on an abrasive belt machine.

The 0·080 in. radii on the opposite edge of the bar are first rough formed by milling, and the finish grinding operation is then carried out on two work-pieces at once, clamped side by side with a spacer between. Two formed grooves are crushed in the grinding wheel, which is of grade AA.150.LV., and the output obtained is 16 pieces per hour. Upon completion of this operation, the parts are placed in special trays to avoid damage to the ground surfaces, and are then subjected to an inspection operation, before they are nitrided to produce a hard wearing surface. Straightening is again carried out after heat treatment, and the parts are then dipped in a rust preventative before being delivered to stores.

Fig. 13 shows another Class 31 accounting machine component, which is form ground, by the crushed-wheel method, on the hook surfaces to the dimensions in the sectional view. Known as a printer trigger, this part is produced from mild-steel drawn section material supplied by John Rigby & Sons, Ltd., and after preliminary milling, deburring, straightening, and turning operations, it is

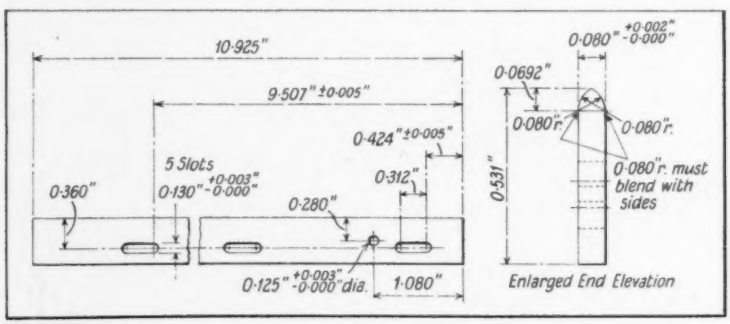


Fig. 12. Steel aligning bar, for a National Class 31 accounting machine, which is form ground on the Jones & Shipman machine

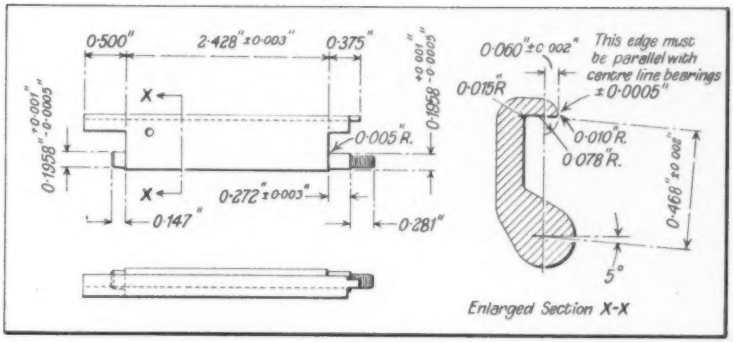


Fig. 13. Component produced from drawn steel section which is subsequently profile-ground on the Jones & Shipman machine to the dimensions indicated in the sectional view

copper plated and rough milled on the stepped latch face, and then locally case-hardened on the surfaces which are subsequently to be form ground. The latter operation is carried out on one workpiece at a time, in two passes, and the time required per piece is about 10 min.

The end spigots of this component, it may be noted, are turned to a tolerance of 0·0015 in. on a Herbert capstan lathe. For this operation, the work is located and clamped in an indexing fixture, so that both ends can be located at the subsequent form grinding operation, and limits of ±0·0005 in. for parallelism are maintained. All the turning and threading operations are carried out from the turret of the Herbert machine, and the rough turning operation on the spigots is performed with a high-speed steel hollow mill. Special projecting chasers are used in the Coventry die head for cutting the $\frac{5}{32}$-36 thread. A balance weight is fitted on the back plate of the fixture, and is moved from one position to another, by the operator, when the work holder is indexed, to ensure smooth running of the machine spindle. Including inspections at various stages, some 50 operations are required to produce this trigger component.

The Churchill Fulcro-Sizer cylindrical grinder, mentioned above, is employed principally for finishing small shafts to close tolerances, and a typical set up is shown in Fig. 14. This machine operates on a fully-automatic cycle, and an important feature of the design is that grinding is carried out by tilting the table towards the wheel instead of feeding the wheel to the work. The tilting movement is imparted to the table by an electro-hydraulic control unit, whereby a gradually decreasing feed is applied until the sizing position is reached, and, at this stage, the table can be arranged to dwell, if desired. Upon completion of grinding cycle, the hydraulically-operated tailstock barrel is retracted, leaving the finished piece supported in a loading cradle, ready for removal by the operator. A fresh piece is then placed in the cradle, and the automatic cycle is started by movement of a control lever. Tolerances on diameter of less than 0·0002 in. can readily be maintained on long runs of components, with a surface finish of 3 microinches, when removing 0·010/0·012 in. on

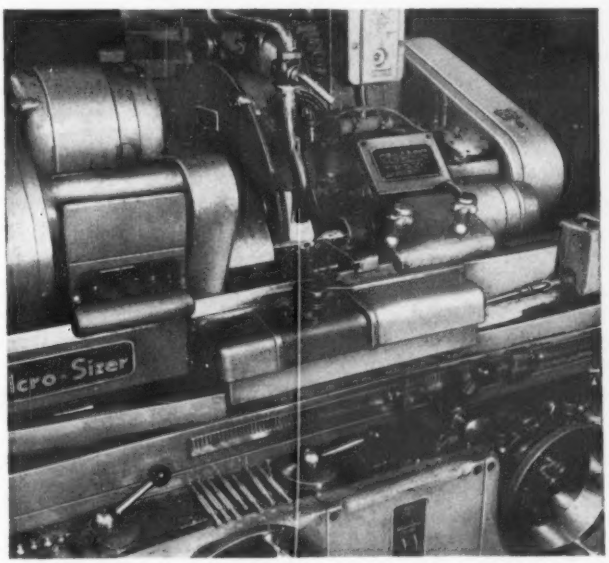


Fig. 14. Churchill Fulcro-Sizer cylindrical grinder installed for handling a variety of shaft components

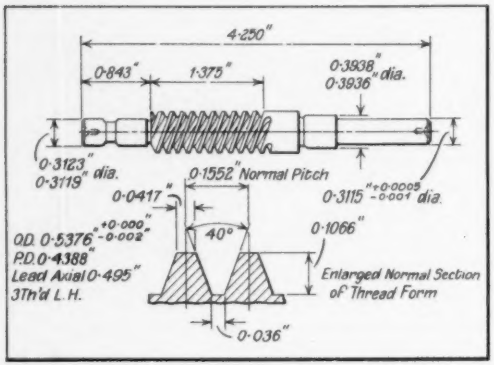


Fig. 15. Thread-ground driving worm shaft for the National Class 31 accounting machine

diameter. A Sigma mechanical comparator is provided, on which the operator checks the work produced. The machine is also employed for light-duty form grinding operations on certain radiused and tapered components. For this purpose, the profile is produced on the wheel periphery by crushing with a gashed roller carried on a mandrel which rotates idly between the machine centres while in-feed is applied.

Among the workpieces handled on the Jones & Lamson type TG615 thread grinder are the two main driving worm shafts shown in Fig. 15 and 16, for the Class 31 accounting machine, and an adding machine, respectively. In Fig. 17, the TG615 machine is seen set up for grinding the smaller worm (Fig. 16). Both worms are produced from cold drawn, stress-relieved, high-tensile steel bar, which is not subsequently heat treated, and the threads are ground from the solid. Each worm has three starts, and is ground in several passes. For the large worm, a total of six passes is taken, the first of which removes 0·090 in. on diameter. Four passes, each removing 0·030 in. on diameter, are then made, and before the final pass (of 0·010 in.) the single-rib wheel is dressed with a diamond. The grinding and dressing cycle is performed automatically, but the work is indexed by hand for producing the three starts. The floor-to-floor time for grinding this worm shaft is 12 min. For the smaller worm shaft, four passes, removing 0·060, 0·020, 0·020, and 0·008 in. on diameter are taken, and the floor-to-floor time is 9 min.

On the Jones & Lamson machine, the work-head and tailstock are clamped to the bed at the required distance between centres, and the thread pitch produced is controlled by a master lead screw and nut at the rear of the headstock, which traverses the work spindle quill. Grinding takes place on both the forward and return strokes of the work, wheel-head infeed being applied at the end of each stroke, and during the traverse motion the tailstock barrel advances and retracts.

The work is located between centres, and rotated by means of a driving dog. Work spindle speeds from 8 to 160 r.p.m. are available, the speed employed for the large worm shaft being 8 r.p.m. and for the small worm shaft, 11 r.p.m. Rapid approach and in-feed of the grinding head is obtained mechanically, and the movements of the motor-driven wheel dressing diamond are controlled by cams. The speed of the grinding wheel is steplessly variable from 1,000 to 3,000 r.p.m. by rheostat control, and when dressing is being carried out, the speed is automatically decreased to reduce wear on the diamond. Wheel crushing equipment is also incorporated, and, if desired, thread grinding can be carried out with multi-ribbed wheels. Provision can be made for grinding in one direction of work traverse only, with rapid return to the starting position.

A 20-in. diameter Norton 38A/120 Alundum wheel is employed for worm grinding, and the coolant is Duckham No. 5447 cutting oil. A Hilger optical projector is provided for checking the thread form produced, and the diameter is measured, by

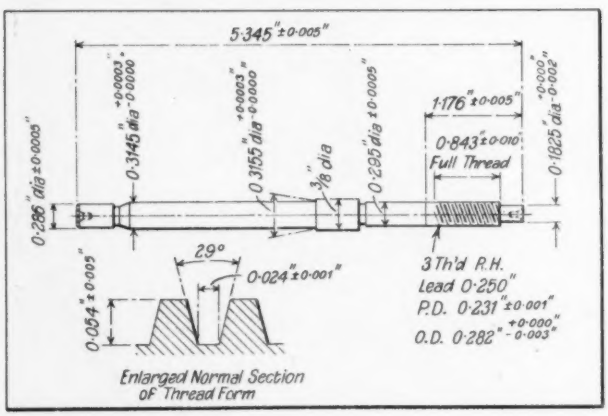


Fig. 16. Driving worm shaft for a National adding machine

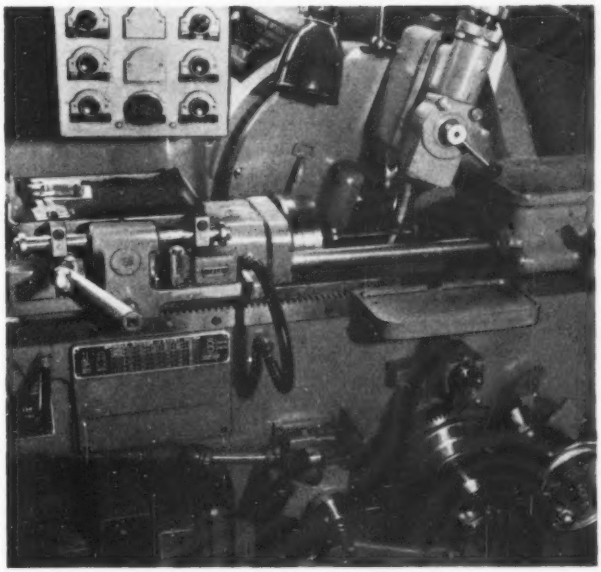


Fig. 17. Jones & Lamson thread grinder set up for producing the threads on the adding machine worm shaft shown in Fig. 16

means of wires, on a Sigma instrument with the work mounted between centres.

SPRING MAKING

The company now has extensive facilities for producing the many types of light springs incorporated in cash registers, and accounting and adding machines. Various kinds of extension, compression, and torsion springs are made from wire ranging from 0·006 in. to 0·080 in. diameter, for which purpose machines by Bennett Tools, Ltd., also No. 0, No. 1, and No. 1½ Sleeper & Hartley machines of U.S. design, are installed (the No. 0 machine being now made in this country by Bennett Tools, Ltd.). In an adjacent section, there are hand-operated bench fixtures for forming the eyes and carrying out other finishing operations on the ends.

One of the British-built Sleeper & Hartley machines in the spring making section is shown in Fig. 18. Comaco spring testers, supplied by Coats Machine Tool Co., Ltd., are mounted on cabinets adjacent to the machines, and enable the operators to maintain a check on the work produced. In the inspection department, Hunter spring testers of U.S. design are also employed. It is the practice to stress relieve compression springs after the coiling operation, and for this purpose they are held at a temperature of 500 deg. F., for 30 min. in a Funditor electrically-heated oven.

INSPECTION PROCEDURES

With the inspection procedure that has been established in the machine shops, no patrolling inspectors are employed, and provided that a particular manufacturing method has been proved satisfactory, the production of good work is largely the responsibility of the operator and the machine setter or section supervisor. For this reason, gauging facilities adequate for the purpose are provided at the machines, and when setting the piece work rates, time is allowed for checking.

All batches of work pass through a main inspection department and both the shop and the inspection gauges are made to the component drawing tolerances. It is not the practice to issue shop gauges of a closer tolerance than that which is acceptable, as a means of maintaining quality. On many components, all the machining operations

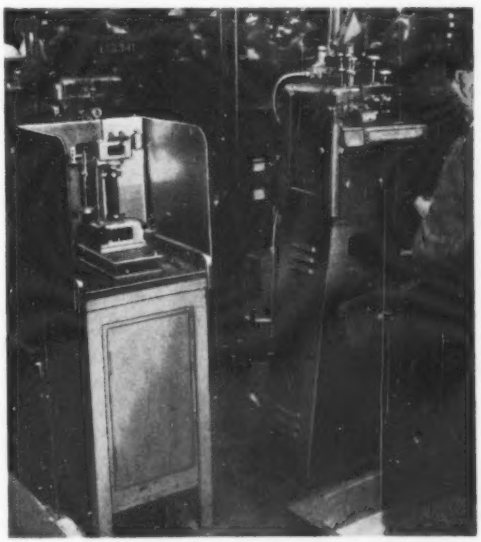


Fig. 18. One of the British-built Sleeper & Hartley machines in the spring-making section

AN EXAMPLE OF THE TABLES EMPLOYED FOR THE SAMPLE INSPECTION SYSTEM

Acceptance Sampling Table	A.O.Q.L. = 2·5 per cent											
Double Sampling	Normal				Tightened				Reduced			
Lot Size	S	C	S2	C2	S	C	S2	C2	S	C	S2	C2
1–10	All	—	—	—	All	—	—	—	All	—	—	—
11–50	11	0	—	—	11	0	—	—	11	0	—	—
51–200	20	0	12	1	25	0	35	2	20	0	12	1
201–400	25	0	35	2	30	0	60	4	20	0	12	1
401–1,000	28	0	47	3	60	1	115	8	27	0	33	2
1,001–4,000	36	0	94	5	95	2	210	13	27	0	33	2
4,001–10,000	65	1	140	8	220	6	410	24	27	0	33	2
10,001–20,000	70	1	170	9	245	6	610	30	27	0	33	2
20,001–50,000	100	2	195	11	360	10	830	43	27	0	33	2
Over 50,000	105	2	245	13	415	11	1,145	54	27	0	33	2

S = 1st sample. S2 = 2nd sample. C = Defectives allowed in 1st sample. C2 = Defectives allowed in 1st and 2nd samples combined. (Derived from Dodge and Romig Sampling Tables.)

required are completed before the batch is inspected, but all work is inspected immediately before and after heat-treatment, and other similar processes. Inspection of surface finish, where it is important, is performed by means of a Profilometer instrument in the inspection department, to which machine setters and charge hands have access, and with polished surfaces, for example, visual comparison is made against accepted samples.

As previously explained, at any one time, a large number of batches of different components is being produced, and in many instances, the batch quantities are relatively small. Quality control by chart methods at the machines is therefore not always practicable, and is mainly employed, for investigation purposes, on long runs of components.

As with jigs, press tools and fixtures, all gauges returned to stores are checked in a section specially provided for the purpose, before they are accepted for re-issue, and gauges in constant use in the shops are inspected periodically according to a date card system. Gap gauges for external measurement are usually of the solid type. In the design of components for the company's products, standard hole sizes are specified wherever possible, and the plug gauges provided for checking purposes do not carry tool numbers, and are withdrawn from use at intervals, for inspection. The standard limits on reamed holes are +0·001 in. – 0, and on drilled holes, +0·003 in. – 0. The centre distance of jig-drilled holes and pierced holes must usually be held within ±0·001 in.

An appreciable number of components is inspected on a 100 per cent basis, but the majority are handled by a sampling system, using Dodge and Romig tables. These tables are so compiled as to ensure that faulty parts delivered to stores do not exceed a specified percentage of the batch, and four average outgoing quality levels (A.O.Q.L.) have been established, namely 0·5, 1·0, 2·5, and 5 per cent. The accompanying table relates to the 2·5 per cent A.O.Q.L., which is the one in most common use. It will be noted that provision is made for three grades of inspection on each card, namely, normal, tightened, and reduced, and the grade to be employed is specified by the inspection department. The method of application can readily be explained by considering, for example, batch quantities ranging from 4,001 to 10,000, which are to be checked to the normal grade. A first sample of 65 pieces, taken at random, is inspected, and if there is only one reject the entire batch is accepted. Should there be more than one reject, but less than eight, the sample of 65 that has been taken is retained and another 140 pieces are taken. These additional parts are inspected, and if there are eight or less rejects in all, the batch is accepted. The entire batch is rejected if more than eight rejects are found. These sampling tables are printed in quantity on pocket-size, 3½- by 2¾-in. thin cards in four distinctive colours, according to the percentage A.O.Q.L., and to withstand shop conditions, each card is enclosed between two sheets of clear plastics material.

For each component, the sequence of manufacture is indicated on the batch progress ticket, and, in addition, for every operation, there is an instruction card, giving detailed information relating to methods, which is held in the machine section concerned. Following the same procedure, inspection instructions cards are compiled which specify checking methods and gauges to be used, and draw attention to any particular requirements, for example, for straightness or surface finish, that have been found necessary from previous experience.

Permanent record cards for each inspection stage for the majority of the different components are also maintained, and are filed in the statistical quality control section of the inspection department. The information entered on these cards includes the quantity in each batch, the date submitted for inspection, the numbers of parts accepted and rejected, the types of rejects found in the

samples taken, and various other details which will facilitate the control of quality. On the reverse side of the card there is provision for making, periodically, an analysis in tabular form of the detailed information compiled on the various batches of work. From this analysis it can be decided whether the inspection procedure can be "reduced," or, on the other hand, whether a "tightened" level of sampling is necessary. These cards are also useful for tracing the history of any components which cause trouble in the assembly shop.

All known scrap components—including setting scrap—are kept separate by the manufacturing section, and are delivered to the inspection department along with the batch of work. This arrangement ensures that the scrap can be properly discarded, and that known rejects do not become mixed with the batch, and inadvertently selected when taking a sample for inspection. The inspection department is responsible for allocating the charge for scrap against the appropriate machine section, also for specifying any additional operations that may be required to rectify rejects.

PREVENTIVE MAINTENANCE

The company is fully aware of the importance of scheduled plant maintenance as a means of obtaining economic flow production, and during the past two years a system has been progressively establishing to cover the machine shops. This phase is now practically completed, and it is intended to apply the same procedure to other factory and office equipment, and to buildings and services.

Inspection and maintenance schedules covering 1-, 3-, 6-, and 12-month periods have been compiled for all the machine tools in the plant, and in each section large wall boards are provided, which list, under their plant numbers, all the machines installed, and indicate the weeks during the year when they must be made available to the plant department for maintenance. The inspection and maintenance procedures to be followed for the various types of machines are specified on instruction sheets issued to the plant electrical and mechanical departments. In general, it is arranged, as far as possible, for maintenance to be carried out during week-ends or holiday periods.

In establishing the system, power presses, which were regarded as being of major importance, were dealt with first, and experience over a period of about 18 months has clearly shown the advantages to be gained. Under the conditions previously obtaining, during the period July to December, 1956, 2,520 man hours were spent on actual plant maintenance, and down-time on the presses was considerable. During the first 6-month cycle of the maintenance scheme, from January to June, 1957, 600 hours were spent on inspection, and 1,170 hours on scheduled maintenance and breakdowns, giving a total of 1,770 hours. In the second 6-month period the inspection time was reduced to 480 hours, and repair time to 990 hours, resulting in a total of only 1,470 hours work. Down-time has also been very much reduced, and it is stated that since the scheme was introduced not a single personal accident has occurred in the press shop.

On the standard report sheet issued for the examination of power presses, the fitter who undertakes the work is required to state the condition of the various components of the clutch mechanism, flywheel bearings, slide, brake, interlock guards if fitted, and any other important working parts. Particular attention is paid to the clutch mechanism, and it is the practice to stamp the date on the clutch keys of all new presses, and to date-stamp

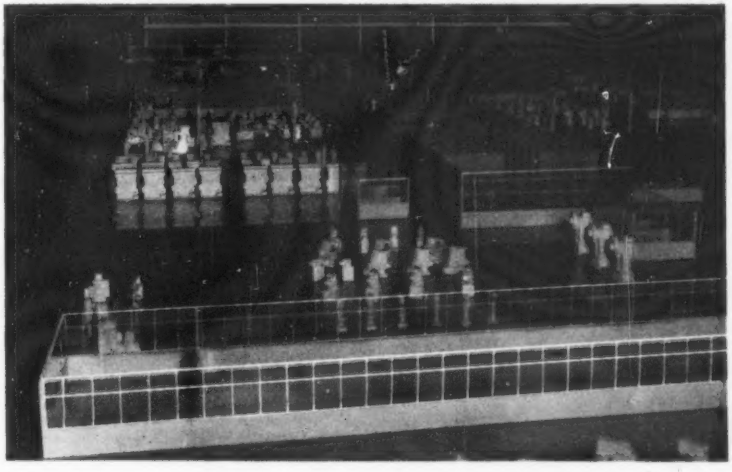


Fig. 19. View of part of the scale-model layout of the main machine shops which is employed as an aid to factory planning

them again at each inspection. After 12 months' service, the clutch key is renewed, irrespective of its condition. If the fitter considers that the press flywheel should be removed for a more detailed examination of the clutch mechanism, the report sheet is signed to this effect, and the work carried out. When a press is ready to be put into production again it is tested in the presence of the maintenance foreman, the shop foreman, and the company's safety officer, who then sign the report sheet if they agree that the press is satisfactory for production. The safety officer, it may be noted, is also provided with special labels which he can affix, at any time, to machines considered to be faulty from the point of view of safety. Repairs must then be carried out before the presses can be released for production, and it is not permissible for any one except the safety officer to remove such a label.

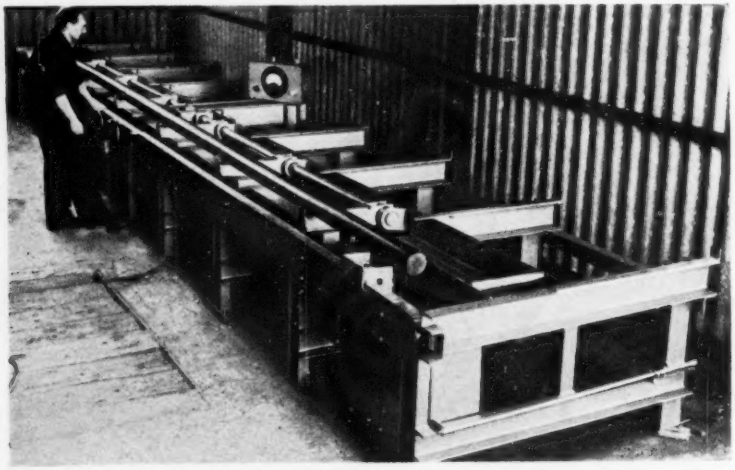
Attention may here be drawn to the effective use which the company make of scale models of machine tools and equipment as an aid in preparing plant layouts. In a separate room in the plant office, the layout of all the machine shops is shown by these models, on a special table, which is marked to show the floor plan and measures 15 by 6 ft. A view of part of this layout is given in Fig. 19. Many of the models were supplied by Visual Planning Systems, Ltd., who specialize in this field.

Large Magnetic Crack Detector

Designed for the surface inspection of bars up to 6 in. diameter by 30 ft. long, the magnetic crack detector here shown, to which brief reference has already been made in MACHINERY, has been built by Johnson & Allen, Ltd., Smithfields, Sheffield, 3.

Bars to be checked are first loaded on to a rack, of 5 tons capacity, on the rear of the frame, and are then rolled forward, one at a time, as required, so that they rest against stops at the front ends of six short arms, as seen in the illustration. Each arm incorporates a roller on which the bar is carried, and with this arrangement, unloading is easily effected axially after the checking operation has been performed. At the opposite ends, the arms are secured to a common shaft which is divided at the centre by a crank operated by a double-acting air cylinder.

In operation, when air under pressure is admitted to the appropriate end of the cylinder, the shaft is turned through a small angle with the result that the free ends of the arms are swung downwards and the bar is lowered on to V-blocks in a bath of Neocol ink, which contains small iron particles. Next, an alternating current of high amperage is passed through the bar. Air is then admitted to the opposite end of the cylinder so that the bar is lifted on the arms out of the ink bath, and the positions of cracks can then be detected by the presence of iron particles.



Large Johnson & Allen Magnetic Crack Detector

Ink in the bath is agitated continuously by means of submerged air jets to prevent the iron particles from settling at the bottom. In addition, exhaust air from the cylinder is discharged into the bath to increase the degree of turbulence. The air control circuit provides for lowering and raising the load at a constant rate, regardless of variations in the weight. Current in the electrical circuit can be varied to suit bars of various sizes, and is indicated on an ammeter.

Typical Operations on Rocket Components

By CHARLES O. HERB and W. EDWARD MOLLER*

More than one million liquid- and solid-propellant rockets have been produced by the Aerojet-General Corporation during the past few years, and power plants and boosters of this type, also various components, are being supplied for use in many of the missiles constructed in the U.S.A.

These products must operate satisfactorily in space flight, at the extremely high and low temperatures encountered. In addition, engines and components for missiles must withstand high internal pressures, and the action of corrosive liquids and gases. Components and welded assemblies must be machined to close tolerances to meet the exacting requirements. It has also been necessary to develop methods of machining parts of unusual contour and complexity. For example, 4,000 holes of small diameter must be drilled in one part to accurate centre distances. In addition, many of the components are made from high-strength heat-resisting metals which are difficult to machine.

This article describes some typical operations performed in the machine shop of the liquid-rocket manufacturing plant which was provided by the U.S. Air Force at the Sacramento, Calif., works of the Corporation. This plant operates 24 hours a day, six days a week. Much of the work carried out cannot be described because of security regulations.

Machines installed include a Monarch Dyna-Shift engine lathe with a swing of 48 in. over the ways and 36 in. over the cross-slide, which will admit parts up to 63 in. long between centres. This lathe is employed for a wide variety of work, including turning and facing of the front and rear surfaces of injector heads to elaborate contours. One side of the injector head is concave in general outline and the other convex. The diameter of such a head may exceed 2 ft., and machining is normally carried out in roughing and finishing stages, with intermediate heat-treatment.

Injector heads are machined from 17-7 precipitation-hardened stainless-steel forgings. Many surfaces of the finished heads must be to specified dimensions within ±0·0025 in. Apart from the finishing of the various surfaces, a series of 20 or more annular grooves must be cut in the concave surface of certain injector heads. These grooves are parallel at the top and have rounded roots, and they range from 0·250 to 0·400 in. wide and from 0·250 to 0·400 in. deep. Limits of ±0·005 in. must be maintained for both size and diameter. The lands between the grooves are usually about 0·04 in. wide.

Fig. 1 shows a set-up on the Dyna-Shift lathe for contour-turning an aluminium nozzle of about 15 in. maximum diameter. The path of the cutter is controlled by the stylus of an air-gauge tracer mounted on a bar which extends towards the rear from the tool-slide. Dimensions of this component are held to size within ±0·003 in. The air-gauge tracer enables changes in set-up to be made in a few minutes.

Another feature of this lathe which facilitates the machining of parts made from various materials

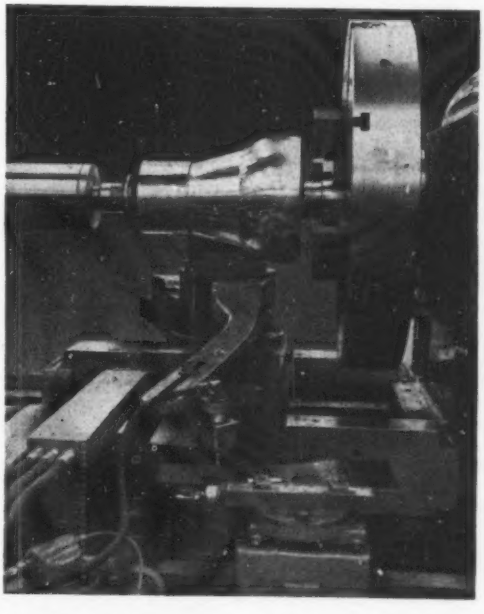


Fig. 1. Set-up for turning a rocket nozzle accurately to the required contour on an engine lathe with an air-gauge tracer

* Liquid Rocket Plant Manufacturing Division, Aerojet-General Corporation, U.S.A.

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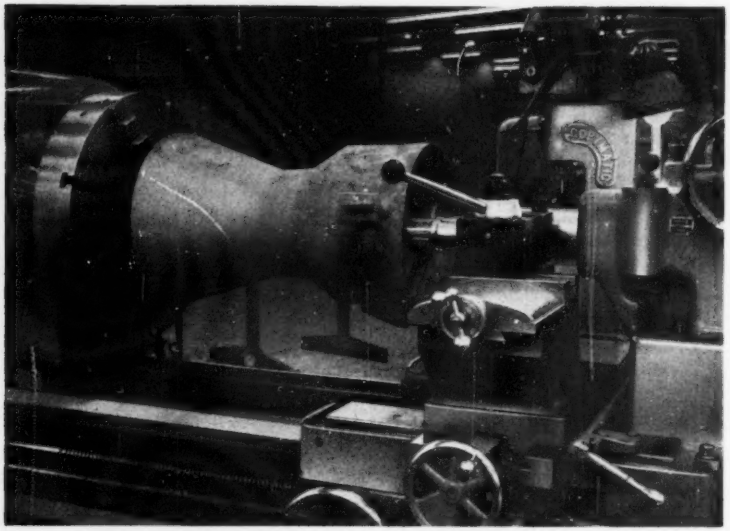


Fig. 2. Machining the large-diameter bore of a case assembly on another engine lathe, with the overhanging end supported by an expanding arbor on the tailstock spindle

is the Dyna-Shift drive to the headstock. Correct spindle speeds for any operation can be determined within seconds without the need for any calculations. The operator sets the indicator to the desired surface speed and then sets another indicator to the diameter of the work. Correct speed for the cut is then obtained automatically, and is shown on an indicator for reference purposes.

The bore of a case assembly is machined on a Lodge & Shipley lathe, as shown in Fig. 2, within limits of 16·625 and 16·635 in. This welded component, which is of 17-7 precipitation-hardened stainless-steel, has an overall length of approximately 30½ in. The boring cuts are taken for a length of 4 in. Support for the overhanging end of the work is provided by an expanding arbor mounted on the tailstock spindle.

An ingenious step-drilling operation on an injector plate is performed on the special Leland-Gifford machine shown in Fig. 3. This part, also, is of 17-7 precipitation - hardened stainless steel, and is approximately 20 in. square. Twenty-five holes of 0·250 in. diameter must be drilled from all four sides. One hole is drilled at a time, to a given depth in the part, by each of the two opposed drill spindles, the greatest depth being approximately 9 in. After the holes have been drilled from two sides, the plate is indexed through 90 deg. on its fixture to present the remaining sides of the plate to the spindles. Similar holes are then drilled from these sides, and the passages formed must intersect within 0·005 in.

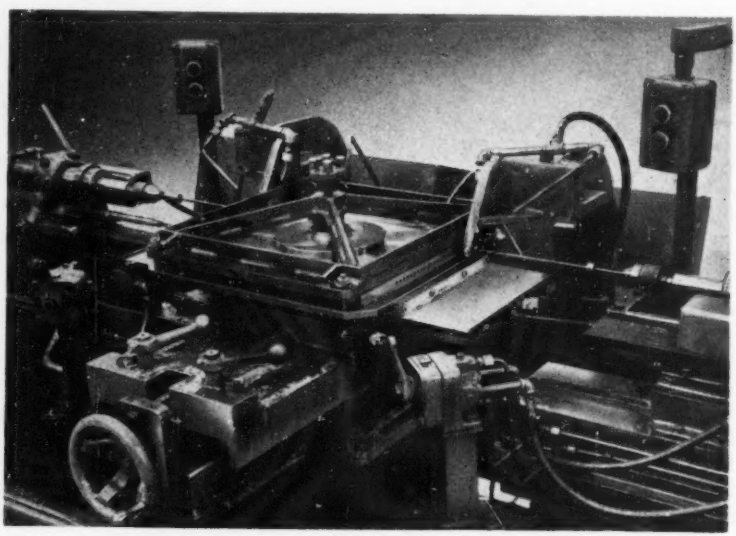


Fig. 3. Twenty-five holes of small diameter are drilled from all four sides in this injector plate. The opposed holes must be aligned within a tolerance of 0·005 in. at a depth of 9 in.

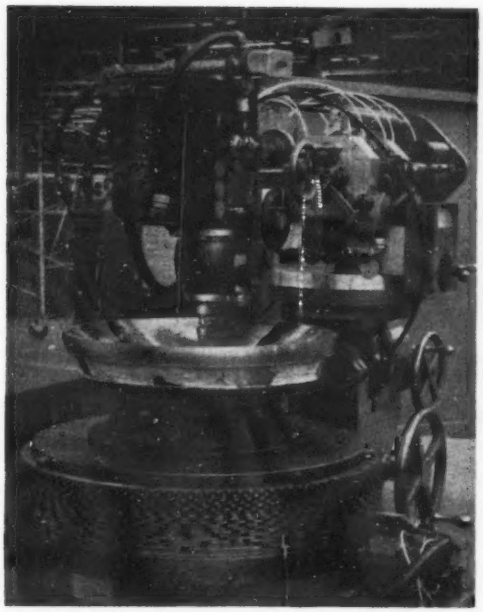


Fig. 4. Four thousand holes of small diameter are drilled to accurate centre distances in injector heads on this machine which incorporates a special indexing arrangement

Movement of the fixture from rear to front to position the work for drilling successive holes is effected by means of a handle at the front of the cross-slide. Movement of the handle actuates a plunger which engages with a series of locating grooves in a bar. The drilling heads are traversed hydraulically, and the operation is performed in steps.

Four thousand holes of 0·072 in. diameter are drilled in certain injector heads on the special machine in Fig. 4, which is equipped with a Dumore automatic drill unit.

Accurate indexing is ensured by engaging a dog (mounted on a slide seen at the right) with notches in the circular indexing plates provided on the table of the machine. Location of the circles is obtained by adjusting the drill-head unit in relation to the centre of the work. For this purpose, the head is mounted on a square arbor that slides in a guideway at the rear. The correct positions of the drill-head unit are obtained by engaging a plunger with detents in a horizontal bar that slides with the head. For drilling the 4,000 holes about 30 hours is required.

Sometimes the work assigned to the large Carlton radial drilling machine in Fig. 5 seems rather incongruous. It is shown set up for drilling small holes round the flange of a fuel fitting assembled to the injector end of a large thrust chamber. This part could not be drilled until the thrust chamber had been assembled, and because of the height of the unit, the operation had to be performed on a radial drilling machine with a high column.

It will be seen that the thrust chamber is mounted in a fixture constructed from tubing which permits convenient transfer about the shop. A pit has been provided at one side of the radial drilling machine to enable work to be handled which is higher than the distance from the floor or table to the spindle nose, when the arm is at its maximum height. At the same set-up, 24 holes are drilled around the central portion of the engine face. For this operation, the spindle is automatically fed to within $\frac{1}{32}$ in. of the required depth, and a special hand feed is then engaged, to enable the holes to be finished to the depth tolerance of 0·001 in.

Radial location of the holes on a pitch circle of 15·50 in. is also held within close limits. To obtain the required accuracy, a master drill jig is employed, which is co-ordinated to a hole pattern

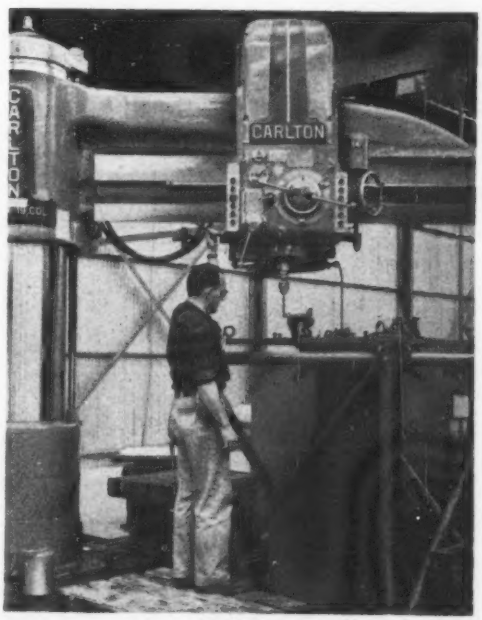


Fig. 5. The height of some assembled missile units necessitates the use of a large capacity radial machine for final drilling operations.

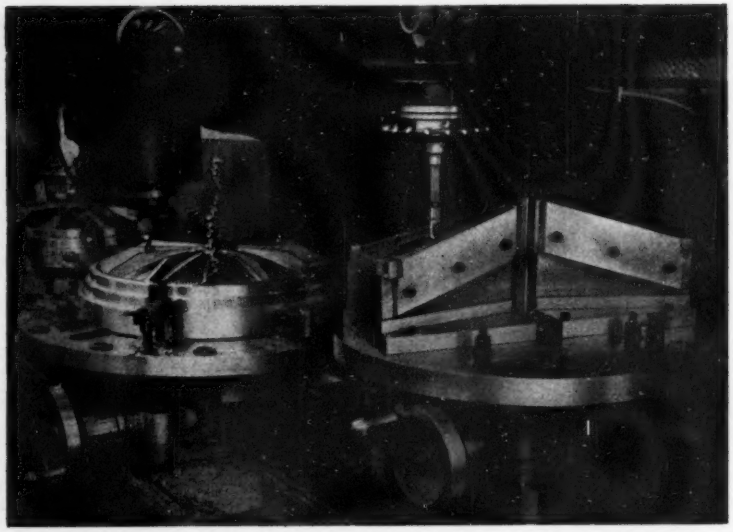


Fig. 6. Close-up view of the set-up on a large Hydro-Tel milling machine for producing 12 propellent cavities in the convex side of each of two injector plates, simultaneously. The arrangement of the two templates required is clearly shown

on the injector head. Hole centre distances must be correct within 0·0005 in.

A large Cincinnati Hydro-Tel milling machine, a close-up view of which is given in Fig. 6, is also employed for a considerable variety of work. For the operation shown, only two of the three milling spindles can be employed because of the size of the work. With this set-up, injector heads of 17-7 precipitation-hardened stainless-steel are machined on the outer surface to form the propellant-manifold feeding cavities. There are 12 cavities in each of these heads.

The cutter movements are controlled by a stylus from two templates, as seen at the right. Two templates are required because there are cavities of two different forms around the injector head. When one series of cavities has been milled, the circular table on which the templates are mounted is indexed through 180 deg. to bring the second template into position. The cavity depth ranges up to 1½ in. and must be held to limits of ±0·005 in. Subsequently, the cavity surfaces are finished to a high degree of smoothness by hand polishing.

Another Cincinnati Hydro-Tel machine is shown in Fig. 8, set up for an operation on a spider gimbal. The part is produced from a solid aluminium billet, which is first rough-cut to the approximate outline on a DoAll band-sawing machine. Pockets are then milled in the legs of the gimbal, and, finally, the complete profile is milled accurately to the required outline.

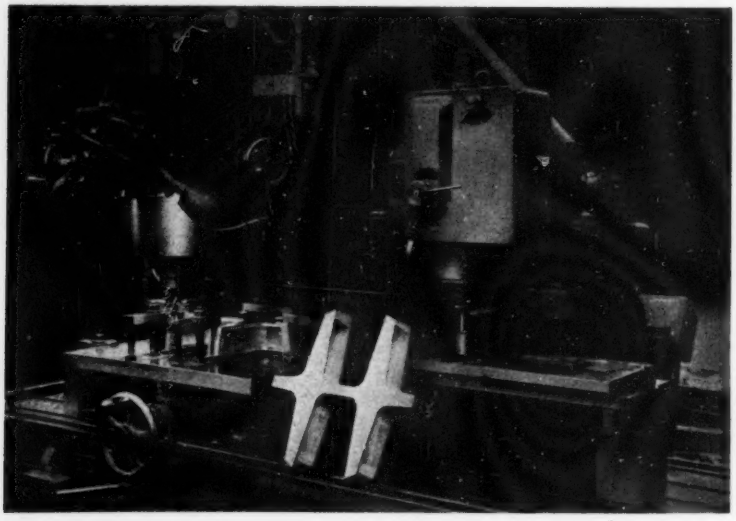


Fig. 7. Hydro-Tel machine set-up for the final contour milling operation on a spider gimbal which is machined from a solid block of aluminium

Multifactor Type 22 Automatic Rotary Transfer Machine

The type 22 automatic rotary transfer machine shown in Fig. 1 is the latest addition to the Multifactor range built by Haesler-Giauque & Cie, Boudry, Switzerland.

Indexing work tables with different numbers of air-operated fixtures up to 12 can be provided, and vertical- and horizontal-spindle tool heads with hydraulic feed cylinders may be mounted on the substantial cast-iron base at the various machining stations. Provision can be made for the work fixtures to be turned on their own axes while the table is being indexed, and then located, positively, by plungers, so that different faces of the workpiece can be presented to the cutter heads.

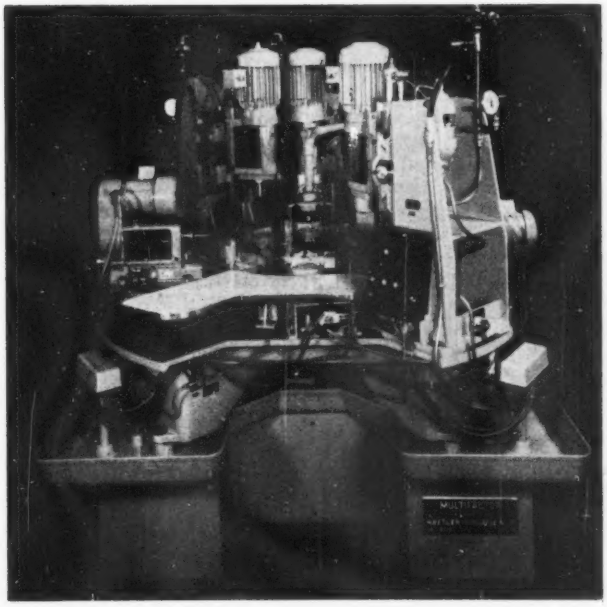


Fig. 1. Multifactor type 22 automatic rotary transfer machine

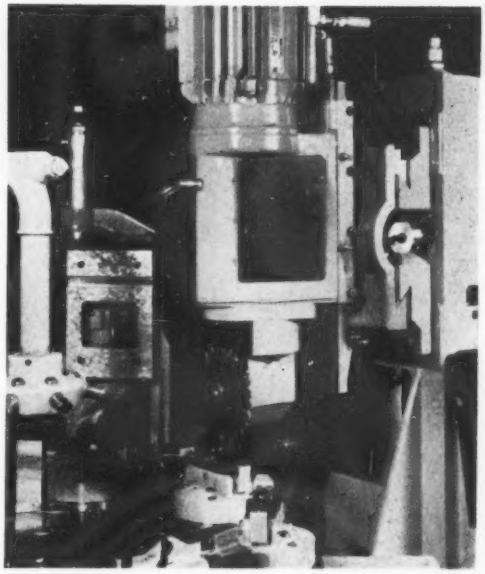


Fig. 2. The vertical-spindle heads are mounted on compound slides with power feeds, and may be fitted with right-angle drive attachments for side and face milling cutters, as here shown

The vertical-spindle heads may be fitted with swivelling, right-angle drive, attachments for the mounting of side and face milling cutters as shown in the close-up view Fig. 2. Alternatively, they may be equipped with twist drills and end mills. Each head is mounted on a compound slide, and vertical and horizontal power feeds can be applied successively, for example, when slots are to be milled in the workpiece. Vertical feed strokes of 3, 5 and 8 in., and various horizontal traverses can be provided. Rapid return of the spindle head, vertically and horizontally, to its starting position, at the end of the cutting cycle, is effected by an air-hydraulic accumulator.

Different feed strokes can also be provided for the horizontal spindle heads, one of which is shown in Fig. 3. The spindle, gear box and drive assembly is traversed hydraulically on guideways on a base during

the cutting stroke, and, upon completion, is returned to its starting position by a pair of powerful tension springs. To enable the spindle head to be adjusted for height, the base guideway member is mounted on a pair of wedges.

Drive for the vertical- and horizontal-spindle heads is taken from 2½-h.p. motors, and oil mist lubrication is provided for the spindle bearings and gear boxes. The working stroke of the hydraulic feed cylinder is controlled, positively, by a stop, and the spindle head can be adjusted on its guideway by a micrometer screw for varying the depth of cut. The spindles are bored at their nose ends to take holders for pre-set cutting tools.

Feed motions are derived from a camshaft which is mounted at the rear of the bed and driven by a 2-speed pole-changing motor through a flat belt and pulleys and worm gearing. Different cycle times are obtained by means of interchangeable belts and pulleys. Plate-type cams mounted on this shaft operate, through the medium of spring-loaded followers, the pistons of hydraulic cylinders, which are connected by pipes to the feed-cylinders incorporated in the cutter heads. Discharge of fluid from one cylinder, by the action of a cam, thus results in operation of the corresponding feed cylinder, so that the associated spindle head is advanced to perform the cutting stroke.

For indexing the work table, motion is transmitted by gearing from a Geneva mechanism which is connected to the worm in the camshaft drive by a universally-jointed shaft. When all the spindle heads have been brought clear of the work, upon completion of the cutting cycle, the higher motor speed is automatically engaged so that rapid indexing of the work table is obtained.

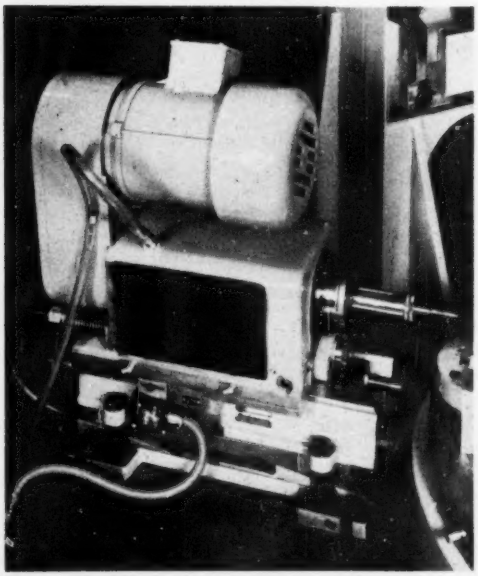


Fig. 3. One of the horizontal-spindle cutter heads on the Multifactor machine

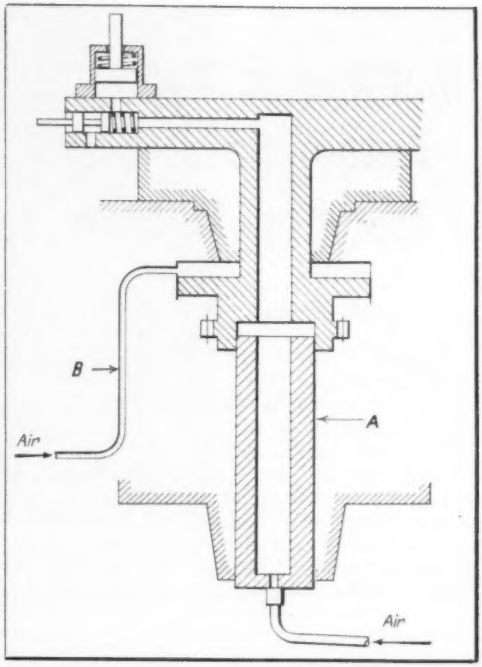


Fig. 4. Diagrammatic sectional view of the table, showing part of the compressed air system for operating the work fixtures, also clamping and relieving the table

Referring to the diagram, Fig. 4, compressed air for operating the work-holding fixtures passes through the fixed sleeve *A* and a central bore in the table stem, to radially-extending holes. Plungers, projecting from the periphery of the table, are operated, in turn, by a small air cylinder at the unloading station, to release the component in readiness for removal from the clamping jaws either by hand or by an air-operated ejector. A plunger can also be depressed, by hand, for releasing a workpiece at any machining station, if required.

Upon completion of the indexing movement, compressed air is delivered through the pipe *B*, to the top surface of a large-diameter flange at the

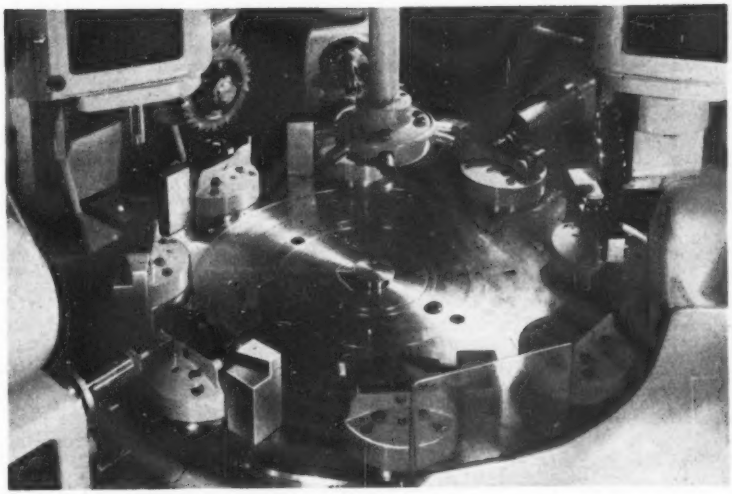


Fig. 5. Close-up view of the 8-station work table and cutter heads for machining the part shown at *A* in Fig. 6

lower end of the stem, so that the table guiding surfaces are held in close contact with the bedways, in opposition to the force exerted by the air pressure in the central bore. At the same time, the table is accurately located for angle by a wedge-shaped plunger which is brought into engagement with a slot in the indexing ring by an air cylinder. In readiness for the next indexing movement, the plunger is withdrawn from the ring, and the compressed air supply to the flange on the table stem is interrupted. As a result, the table is partly supported by the air pressure in the central bore, and indexing is thus facilitated.

At one end of the camshaft, there is a number of adjustable trip dogs for operating micro-switches which form part of a comprehensive system of electrical interlocks. Faulty operation of the machine, resulting, for instance, from a cutter having become blunt or broken, causes the pressure in the hydraulic system to rise, and the main driving motor is then automatically stopped. Rapid stopping of the camshaft, and, consequently, of the feed motions, is insured by an electro-magnetic brake on the driving motor.

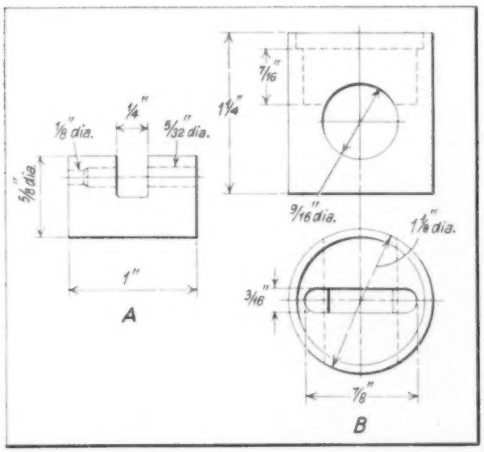


Fig. 6. The cycle time for machining the part *A* on the Multifactor machine is 10 sec., and for the part *B*, 15 sec.

The operating cycle is controlled by push-buttons mounted on a panel at the loading station. When a fresh blank has been mounted in the fixture at this station, depression of the push-button marked "clamp," while machining is in progress on other components, causes the machine to resume its automatic cycle of operations. Clamping of the work at the loading station, indexing of the table, and operation of each spindle head, are indicated by coloured signal lamps on a separate floor-mounted cabinet which houses the electrical equipment.

The machine can be supplied fitted with work-holding fixtures and spindle heads for handling a variety of small- and medium-size components, and a set-up for performing numerous operations on zinc pressure die-cast bodies and covers for windscreen wipers was described in MACHINERY, 91/807—4/10/57. Fig. 5 is a close-up view of a 32-in. diameter 8-station work table and the tool heads employed for machining the cast iron component seen at *A* in Fig. 6. When required, however, the machine can be quickly set for performing operations on the mild steel part shown at *B*.

Referring again to Fig. 5, a blank for the part *A* is loaded horizontally into the fixture at the extreme right-hand side, and when the table has been indexed (in an anti-clockwise direction) the central

slot is rough milled by a side and face cutter. For this operation, the vertical spindle head is fed downwards and then horizontally. At station 3, the $\frac{3}{32}$-in. diameter portion of the off-centre stepped hole is drilled lengthwise in the component with a horizontal spindle head. This head differs from that previously described in that the body carries a bracket to take a guide bush for the twist drill, and feed is applied to the quill which surrounds the spindle by a hydraulic cylinder, through a rack and pinion. A machined face is provided at the front of the body, on which a spindle unit with power feed may be mounted vertically.

The ¼-in. diameter end of the stepped hole is drilled at station 4 by a horizontal spindle head of the type shown in Fig. 3. Finish milling of the slot is carried out at station 5 with another side and face milling cutter, and station 6 is idle. A stepped reamer is employed at the 7th station for finishing the off-centre hole, and the completed component is removed from the fixture by hand at station 8. The cycle time for performing these operations is 10 sec.

When setting the machine for handling the component *B*, Fig. 6, the pre-set jaw pieces on the fixtures are changed for others of different design which provide for holding the work vertically. The right-angle drive attachments are removed from the cutter heads at stations 2 and 5, and end mills are fitted to the spindles of these heads, also to the head at station 6.

This component is machined in a cycle time of 15 sec., and the sequence of operations is as follows.

At station 1, the part is loaded, and at station 2 the $\frac{3}{16}$-in. wide slot at the upper end is rough milled for part of its depth. Drilling of the $\frac{3}{16}$-in. diameter cross hole is carried out in two stages at stations 3 and 4, and at station 5, the slot is rough milled to full depth. A finishing cut is taken on the slot at the 6th station, and the cross hole is reamed at station 7. The completed workpiece is removed from the fixture at station 8.

Haesler Sales Division of Adam Engineering Co., Ltd., 4 Grange Street, St. Albans, Herts, are the distributors in this country for Multifactor rotary transfer machines .

Measuring Coating Thickness in Bores

In the accompany illustration is shown equipment which is employed by the Hamilton Standard Division of United Aircraft Corporation, Conn., U.S.A., for the non-destructive measurement of coating thickness. One application is concerned with the checking of hard-anodic coatings on aluminium alloy, but other metallic and non-metallic coatings, produced, for example, by plating or painting, can also be measured.

A Standard Dermitron type D-2 instrument is used in conjunction with a right angle probe. The latter is mounted in a special holder, of Hamilton design, which, in turn is fitted to a conventional height gauge. With this equipment, measurements may be made on the surfaces of holes down to ½ in. diameter. The Dermitron unit operates on the eddy current principle, and can be suplied with four right-angle probes to cover a range of coating thicknesses.

Dermitron Equipment for Measuring Coating Thicknesses in Bores

Italian Machine Tool Exhibition, Milan—1

The first Italian Machine Tool Exhibition, organized by Unione Costruttori Italiani Macchine Utensili (U.C.I.M.U.) and held in Milan from September 12 to 21, was supported by some 530 firms, who occupied stands covering an area of about 270,000 sq. ft., and although the majority of the machines shown were of Italian make, an appreciable number of British, American, Belgian, French, German and Swiss machine tools were to be seen on the stands of the Italian agents. Some examples of machines from East Germany, Czechoslovakia and Hungary were also shown. An important section of the exhibition was devoted to cutting tools, gauging and measuring equipment, welding machines, die casting machines, and electrical equipment, and a certain amount of foundry equipment was also on view.

According to a report recently compiled by U.C.I.M.U., the production of machine tools in Italy rose from 23,550 tons in 1956 to 26,000 tons in 1957, and more than 50 per cent of the output was exported, principally to countries in Western Europe. Production for the first half of this year totalled 15,500 tons, and there has been an upward trend in exports. Imports of foreign machine tools for the Italian metal-working industries, on the other hand, have shown a sharp decline, and in the first part of this year they were about 50 per cent lower than in the corresponding period in 1957. The range of machine tools built in Italy has been rapidly extended during the past few years, and the requirements of the metal-working industries there are being met to an increasing extent by Italian machine tool makers. From the machine tools exhibited, it is evident that Italian firms in this field have a full appreciation of present day production requirements and of up-to-date trends in the design of both standard and special-purpose equipment. Details of some of the Italian-built machine tools that were demonstrated are given here.

ZOCCA GRINDING MACHINES

Officine Meccaniche G. Zocca (Machine Tool Sales, Ltd.), who now employ about 300 people in their works at Como, exhibited some 14 machines from the extensive range of cylindrical and surface grinders which they make. Of particular interest is the type of R.P.S. hydraulic piston grinder, of patented design, shown in Fig. 1, which operates on a fully-automatic cycle and permits various combinations of ovality, and taper or barrel forms to be obtained. It will accommodate 10-in. between centres, and the maximum grinding diameter is 7 in. Workhead speeds up to 500 r.p.m. are provided, and the steplessly-variable traverse speeds for the hydraulically-operated table range from 2 in. to 26 ft. per min.

A close-up view of the workhead, with the cover removed to show the mechanism for producing ovality, is given in Fig. 2. Drive to the work-head *A* is taken, by V-belt, from a motorized speed

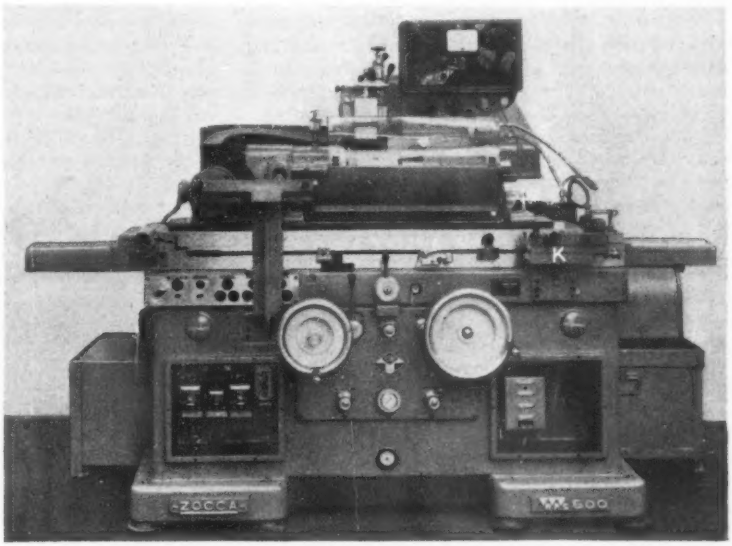


Fig. 1. Zocca type R.P.S. hydraulic grinder of patented design, for pistons up to 7 in. diameter

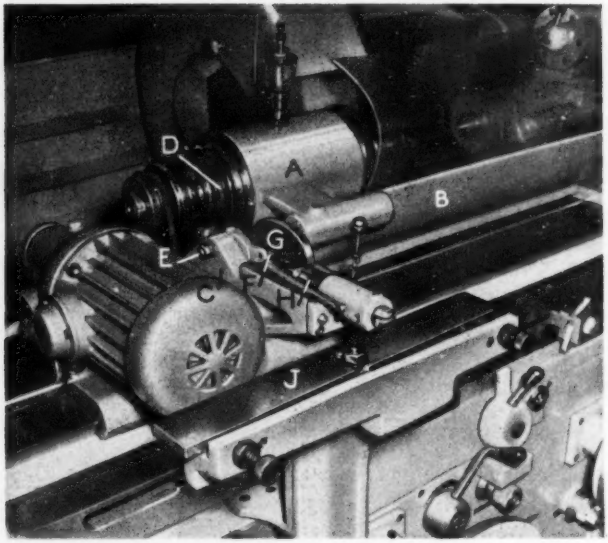


Fig. 2. Close-up view of the workhead on the Zocca piston grinder, with cover removed to show the mechanism for producing the required ovality

reduction unit mounted on the top table, the latter being swivelled during the traverse stroke of the main table to produce the required taper or barrel form on the piston. The work-head is integral with a cradle *B*, which is trunnion mounted at each end in brackets clamped to the top table, and is provided with a T-slotted machine face to take the tailstock. The trunnion bracket at the workhead end is seen at *C*.

Oscillation of the cradle, to produce the desired oval cross-section of the piston, is effected by an interchangeable cam *D*, on the workhead spindle, which is engaged, from beneath, by a roller carried on a horizontal lever pivoted at *E* in the trunnion bracket. A roller *F*, on the opposite end of this lever, bears against the under-side of a hardened-steel rocking plate *G*, which is pivoted on a horizontal axis in the cradle. Also in contact with the lower face of the plate *G*, is a roller carried on the end of a horizontally-moving bar *H*, and another roller, at the opposite end of this bar, is held, by means of two tension springs, against a template bar *J*, mounted on a bracket bolted to the machine bed. The template bar can be adjusted angularly, and serves to alter, progressively, the fulcrum point of the cradle pivoting motion during the grinding traverse of the table, the required variation in the amount of ovality along the length of the piston being thus obtained. The swivelling movement of the upper table to produce a taper or barrel form on the work is controlled by means of an adjustable template bar at *K*, Fig. 1. on the main table, which is engaged by a roller on the upper table, under the pressure of a spring at *L*.

The machine operates on a fully-automatic cycle, which is started by moving a lever, and after the rapid approach of the wheel-head, in-feed up to 0·012 in. can be applied before the table traverse motion is engaged. There is a pedal control for the hydraulic tailstock, and a safety interlock ensures that it cannot be operated once the automatic cycle has started. Grinding wheels up to 16 in. diameter by 3 in. wide can be employed, and the wheel-head is driven by a 6-h.p.

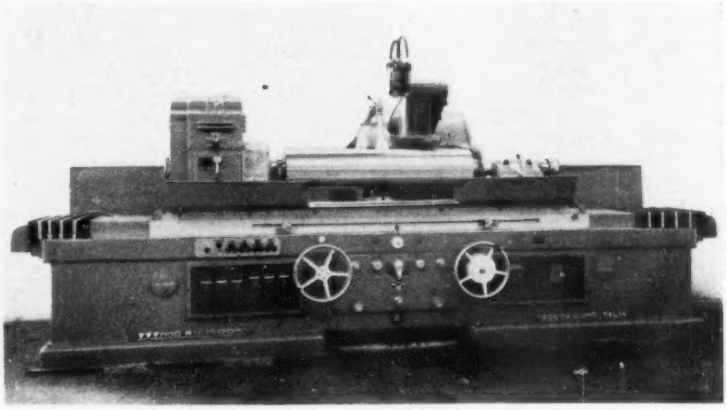


Fig. 3. Zocca type RU1500/6 hydraulic cylindrical grinder of 12-in. centre height, which accommodates 59 in. between centres

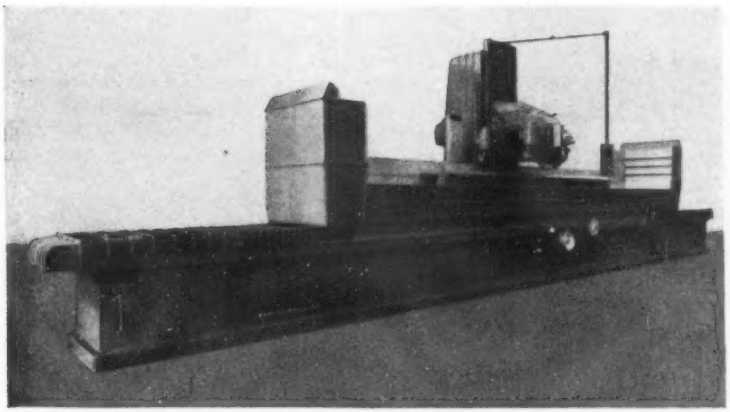


Fig. 4. Zocca type RPA 6000 hydraulic slideway grinder

motor. As an example of production times, it is stated that a piston of 4 in. diameter can be ground in 25 sec.

Cylindrical grinding machines made by the company range from the small RA250 universal machine of 4- by 10-in. capacity, up to the large RU-6 series, of 12-in. centre height, which are hydraulically operated, and can be supplied for grinding lengths up to 16 ft. 6 in. As representative of this series, the type RU1500/6 is shown in Fig. 3. It will accommodate 59 in. between centres, and the 26-in. diameter grinding wheel is driven by a motor of 16 h.p. Steplessly-variable wheel speeds, by magnetic amplifier control of the driving motor, can be provided if required, and the machine can be fitted with a high-frequency internal grinding head, or a superfinishing head, as shown, carried on a pivoted mounting on the wheelhead. Provision for hydraulic raising and lowering of these attachments can be made, if desired.

The wheel-head spindles of Zocca grinding machines are made from a nitriding steel, obtained from Sweden, which contains chromium, molybdenum and aluminium, and can be hardened to 70/80 Rockwell C. In addition to this high degree of hardness, the steel has the advantage of a low coefficient of expansion. At the front end, the spindle runs in a plain bearing provided with three tapered, equally-spaced axial ribs on the periphery, which locate in the tapered bore of the wheel-head casting. Axial adjustment of the bush produces the required running clearance by elastic deformation of the metal, which results in three bearing lands being formed for the spindle. Oil is supplied to a point between two of these bearing lands and is drawn between the surfaces in contact by rotation of the spindle, to provide hydro-dynamic lubrication. At the rear end, the spindle is mounted in high-precision anti-friction bearings.

In addition, the company makes a wide range of peripheral-wheel and vertical-spindle cup-wheel hydraulic surface grinders, including large-capacity machines for slideway grinding. The latter, known as type RPA, are available with grinding lengths up to 20 ft., and the largest machine, type RPA 6000, is shown in Fig. 4. It is fitted with a peripheral wheel-head and two vertical-spindle heads, and the maximum grinding cross travel is 24 in. Steplessly-variable traverse speeds up to 100 ft. per min. are available for the table, and the wheel-heads can be traversed continuously at rates up to 50 ft. per min. in the transverse direction. Intermittent cross-feed in increments from 0·08 to 0·8 in. per table stroke, can also be applied. The down feed at each transverse or longitudinal stroke ranges from 0·0002 to 0·0025 in., and the feed can be stopped with a high degree of precision when the required size is reached. Rapid vertical power traverse is provided by a separate drive. The hydraulically-operated dressing device permits wheels to be formed to an angle for grinding V-slideways, and measuring devices can be incorporated in the machine for checking the straightness and profile of the ground ways on the workpiece. It may be noted that a Zocca slideway grinder of 12-ft. stroke, with a 48-in. wide table and a height capacity of 40 in., is being built for Birfield Tools, Ltd., Coventry, who make the Somua type Z milling machines described in MACHINERY, 93/956—22/10/58.

Fig. 5 shows another hydraulic surface grinder from the Zocca range, which incorporates a swivelling column fitted at one side with a vertical cup-wheel head, and at the other with a peripheral wheel-head, which can readily be brought to the working position. Designated type RPAT, machines in this range can also be supplied with a fixed column mounting a peripheral wheel-head only, and they are available with grinding length capacities of 20, 26, 33 and 43 in. Steplessly-variable

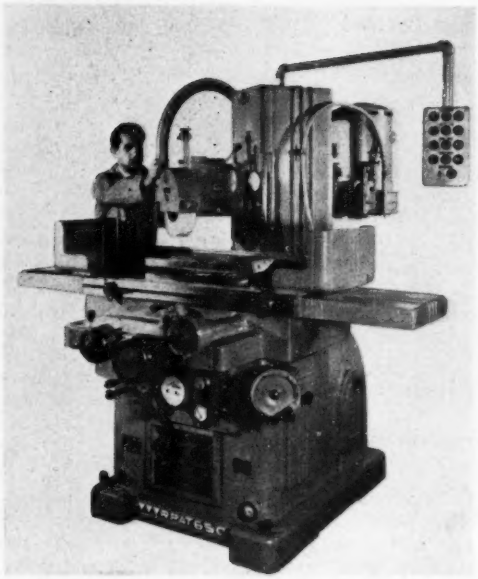


Fig. 5. Zocca type RPAT hydraulic surface grinder with peripheral wheel and vertical cup wheel spindle heads on an indexing column

table speeds up to 100 ft. per min. are provided longitudinally, and up to 50 ft. per min. transversely. Increments of transverse feed from 0·08 to 0·8 in. can be applied at each stroke of the table. Power down-feed to the wheel-head ranges from 0·0002 to 0·0025 in. per stroke, and a precision depth stop is incorporated which automatically trips the feed motion.

MAXNOVA PRODUCTION LATHES

Maxnovo - Meccanica di Precisione, Novara (Catmur Machine Tool Corporation, Ltd.), have been active in the development of their Profilomatic hydraulic copying lathes, and a number of new machines has been introduced. Fig. 6 shows the Profilomatic 320-22—one of a new, standardized MEC series which has been designed to meet the requirements of the small works, as well as the larger plants engaged in quantity production. It incorporates a front hydraulic copying slide and will swing 17⅛ in. over the bed, and 7 in. over the carriage. Features of the design include a single-piece headstock and bed casting, with integral gearbox, and hardened and ground slideways. The headstock spindle has three-point support and runs in pre-loaded high-precision anti-friction bearings. Driving motors up to 13 h.p. can be fitted, and either 6 or 12 spindle speeds, up to a maximum of 1,200 or 1,600 r.p.m. can be provided in the standard ranges, or up to 2,200 r.p.m., in a high range.

The duplicating system, supplied by an independent hydraulic pump unit, enables both transverse and longitudinal copying to be performed, and a multiple, indexing, template holder of patented design is fitted. When 12 spindle speeds are provided, two speeds can be employed during the machining operation without interrupting the cycle, and a lever-operated change of feed rate can also be made. An automatic stop is fitted for the carriage travel, and multiple depth stops for the duplicating slide can be incorporated if desired. Six rates of carriage feed from 0·0047 to 0·020 in. per rev. are normally available, but, if required, 12 rates from 0·002 to 0·020 in. per rev. can be provided. A feature of all Maxnovo lathes, it may

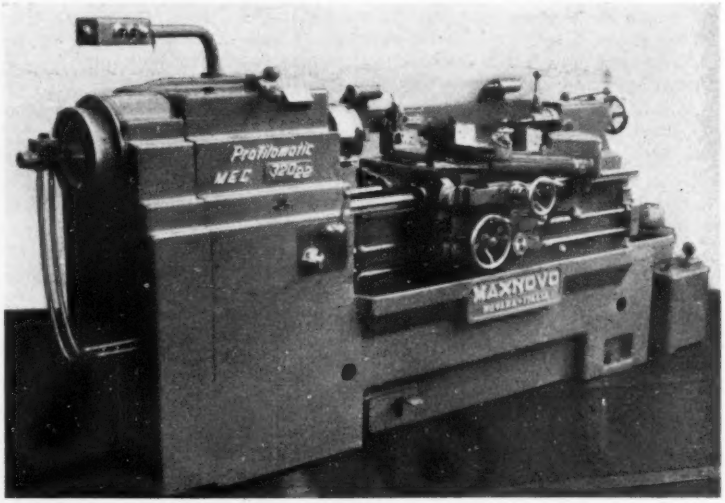


Fig. 6. Maxnovo Profilomatic 320-22 hydraulic copying lathe

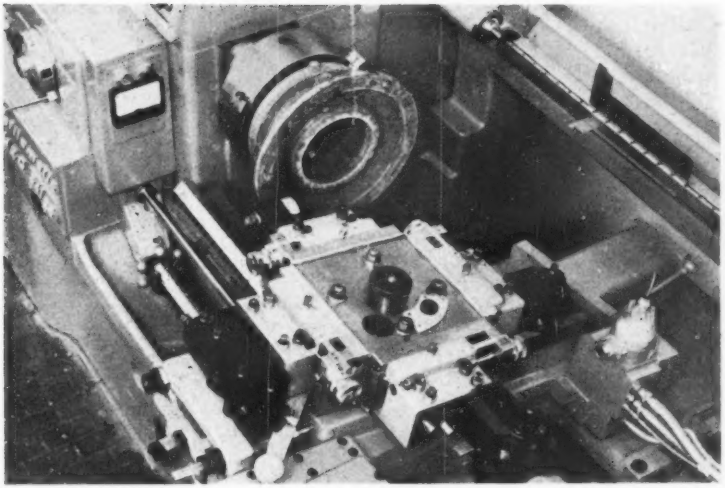


Fig. 7. Close-up view of the Maxnovo Profilomatic 341-25 hydraulic copying lathe, showing the 4-station indexing tool turret

be noted, is the use of the "Polygon K" profile for both sliding and fixed gears and couplings.

Another copying lathe from the standardized MEC range, designated type 311-25, incorporates many of the features of the type 320-22, but is of larger capacity and has a wider scope for quantity production applications. The swing capacity over the bed is 21 in., and over the carriage, 8 in., and a driving motor of 12/15 h.p. is normally fitted. For heavy-duty applications, a motor of 20/22 h.p. can be provided. Sixteen spindle speeds, from 50 to 1,000 r.p.m., or 100 to 2,000 r.p.m., are normally available, but, if required, a 32-speed headstock with a range of 50 to 2,000 r.p.m. can be supplied. Either two or four different spindle speeds can be engaged during the automatic cycle, according to the speed range of the headstock.

The carriage and duplicating slide can be traversed rapidly in both directions, and the carriage is returned automatically to the starting position upon completion of the cutting cycle. Multiple stops for both the carriage and duplicating slide can be fitted if desired. Another feature is the provision of a hydraulic servo control to facilitate traversing the carriage smoothly along the bed by hand. If required, the multiple template holder mounted at the rear of the bed can be arranged for power indexing, under push-button control, and hydraulic operation can be provided for the tailstock. To facilitate the disposal of swarf and coolant, the copying slide is mounted at an angle on the front of the carriage.

Another version of this hydraulic copying lathe, known as the type 341-25, incorporates a 10-in. square, 4-station indexing tool turret on a copying slide of robust design, as seen in the close-up view, Fig. 7. The tool turret is indexed and locked by hand, and power operation, under push-button control, is provided for the indexing template holder. With this arrangement, a workpiece requiring a series of operations, including longitudinal and transverse copying, can be machined complete at one setting.

A new design of hydraulic multi-tool lathe for chuck work, known as the Automax 22, is shown in Fig. 8, fitted with Facomax air-operated loading and unloading equipment. Designed for medium and large batch production, it has a chuck capacity of 9 in., and incorporates a wide carriage whereon can be mounted one or more Maxnovo Unit-Max hydraulically operated tool slide units, arranged according to the requirements of the work. These units have independent feed and rapid traverse motions and can be brought into operation in any desired sequence. The machine cycle is started by depressing a push-button, and upon completion of the operation the carriage returns rapidly to the starting position. Driving motors from 10 to 18 h.p. can be fitted, and spindle speeds up to 2,200 r.p.m. are available, and can be changed during the automatic cycle.

The Facomax air-operated work handling equipment, used in conjunction with an air-operated chuck, is provided with two swinging pick-up arms which are linked together and so arranged that the rear arm picks up a fresh workpiece from the incoming magazine, while, simultaneously, the front arm engages the piece in the chuck. The pick-up heads then move axially and the arms swing over to deposit the finished piece in the outgoing chute, and load the fresh piece into the chuck.

The company has also introduced the rotating-master Profilomatic 350-22 hydraulic copying lathe, of 8½-in. centre height, shown in Fig. 9 This machine, in addition to operations on dies, moulds, cam contours, and other internal or external pro-

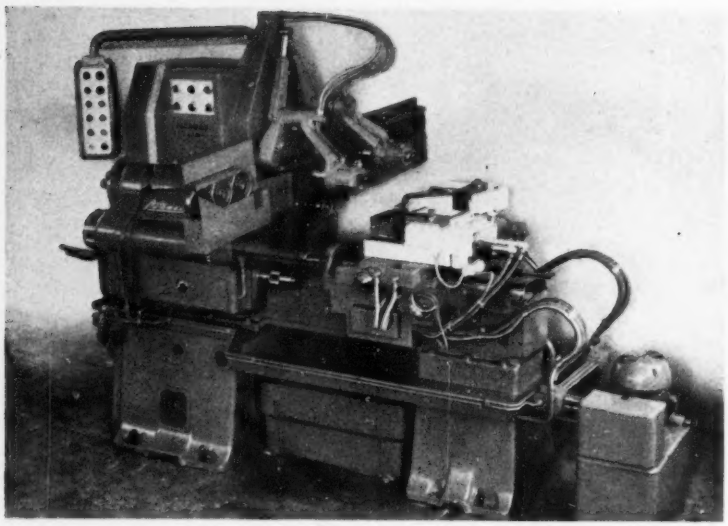


Fig. 8. Maxnovo Automax-22 hydraulic multitool lathe equipped with a Facomax work handling unit

files, can be used for turning shafts and similar workpieces by positioning the copying slide at an angle, and disengaging the rotating drive for the master. It can also be employed for conventional turning operations, and a rear tool-holder can be fitted. Driving motors up to 7 h.p. can be provided, and 15 spindle speeds from 5 to 760 r.p.m. enable a wide range of work to be handled. The spindle is bored 2 in. diameter, and the eight rates of carriage feed normally range from 0·003 to 0·024 in. per rev. The maximum diameter of rotating master that can be accommodated is 12 in.

Reference may also be made to a Profilomatic-AB hydraulic copying lathe, with multiple tool-slides, for the large-scale production of such parts as gear blanks and bearing races. The automatic cycle of this machine is controlled by the firm's Telephotomation punched-card system, some details of which have already been given in MACHINERY, 91/1264 — 29/11/57. The punched-card, in the form of a disc, is placed over an indexing dial with 12 radial rows of holes, each row comprising six holes. Holes in the card correspond to the operation sequence required on the machine, and they allow light from a lamp house at the front to shine through the disc on to a photo-cell at the rear. The electrical impulse thus generated is amplified and operates a relay to change the functioning of the machine. Indexing of the disc can be controlled either by a timing dial in the cabinet, or by means of micro-switches actuated by movements of the machine slides.

Recent development in connection with the high-speed threading lathes built by the Italian firm Mannaioni (Elgar Machine Tool Co., Ltd.) include

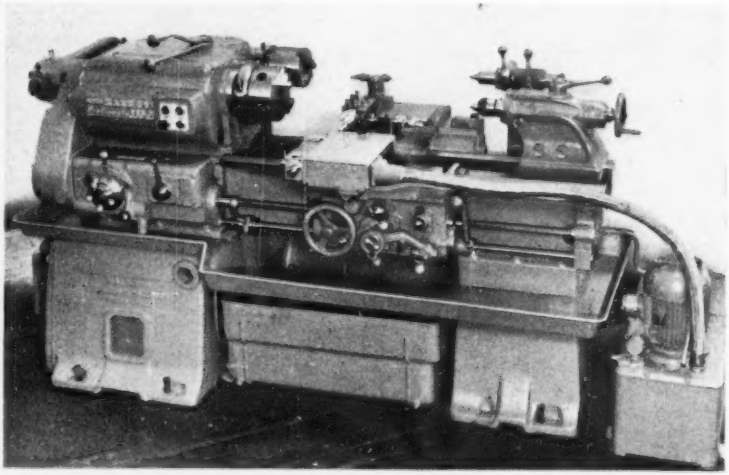


Fig. 9. Maxnovo Profilomatic 350-22 rotating-master hydraulic copying lathe for operations on dies and moulds

the provision of hydraulically-operated attachments for copy turning, facing and cutting off, and taper threading, which considerably increase the scope of the machines.

The firm's Hydro Man-au-cycle 3-in. lathe, which accommodates 36 in. between centres, and will cut threads up to 28 in. long, is shown in Fig. 10 equipped for hydraulic copy turning, and fitted with the taper threading attachment. Arranged overhead, the copying saddle is fitted with an angular tool slide and is traversed by electric motor and screw along an auxiliary bed which is bolted to inclined facings provided for this purpose at the rear of the main bed. These facings also serve for mounting the cutting-off and facing attachment, as seen in Fig. 11. With this arrangement, stepped shafts, for example, which require to be threaded, can be produced at the one set up from bar stock or forgings, with the threads concentric with the plain diameters.

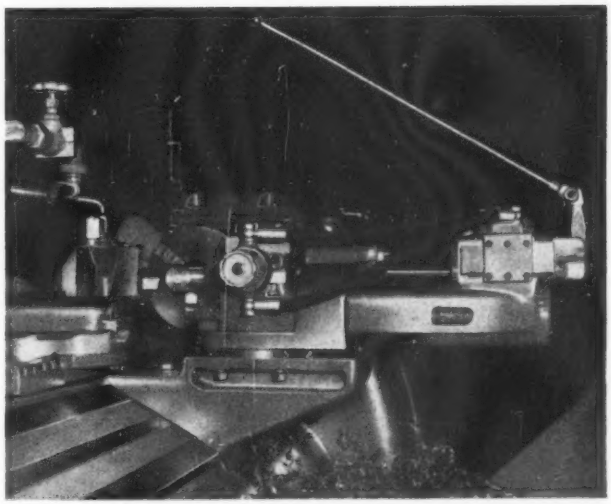


Fig. 11. Close-up view from the rear of the Mannaioni high-speed threading lathe fitted with a facing and parting-off slide

Seen fitted in Fig. 10, the taper threading attachment replaces the normal front cover of the apron, and can be mounted in only a few minutes. Control of the threading tool slide, to produce the required taper, is effected by a copying system superimposed on the existing hydraulic control arrangement for the slide, and a roller-type stylus is employed which makes contact with an adjustable sine bar fastened at the required position on a mounting plate bolted to the front of the base casting.

The hydraulically-operated facing and cut-off slide (Fig. 11) permits threaded pieces to be conveniently produced from bar stock, and it can also be employed for carrying out chamfering and undercutting operations, for example. Provision is made, when facing, for retracting the tool axially by a small amount, to avoid drag during the return stroke. The cycle of rapid approach, in-feed, and quick return is initiated by moving a hand lever.

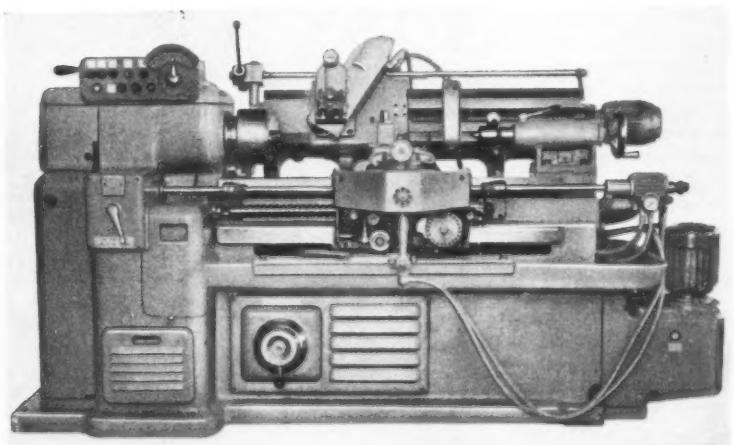


Fig. 10. Mannaioni Man-au-cycle high-speed threading lathe equipped for taper threading and copy turning

ATTACHMENTS FOR RIGIVA MILLING MACHINES

A noteworthy feature of the Rigiva knee-type milling machines made by Officine Riva (Thos. W. Ward, Ltd.) is the extensive range of attachments that is now

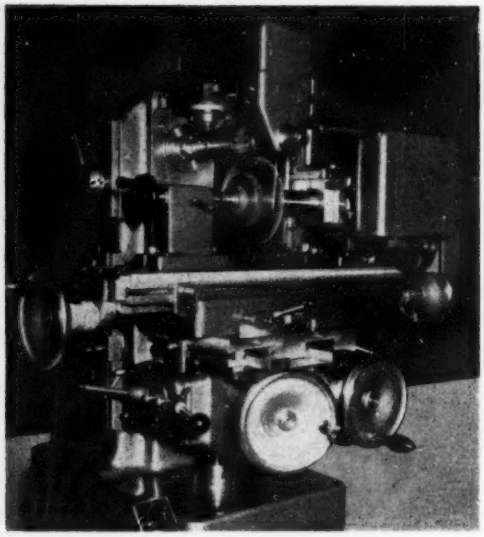


Fig. 12. Rigiva horizontal mill with a hobbing attachment for spur and helical gears

available, whereby the field of application is considerably increased. Fig. 12, for example, shows the latest design of hobbing attachment, which enables spur and helical gears to be hobbed, also spline shafts and chain wheels. It has a capicity for hobbing gears up to about eight module, and the number of teeth cut is determined by change gears on the dividing work-head. Drive to the work-head is transmitted from a bevel gear carried on the spindle arbor, which meshes with a gear housed in a bracket, the latter being mounted on the lower dovetail ways of the overarm. From this bracket, the drive is taken by way of gears and a horizontal and a vertical shaft,with provision for the gears to slide on the shafts to permit the machine table to traverse, and the knee to be adjusted vertically for the required depth of cut. Spiral gears up to 45 deg. helix angle are hobbed by swivelling the machine table, and for gears of greater angle, a special swivelling hob spindle head is available, which is bolted to the machine column and driven from the main spindle nose. An attachment for manual indexing can be fitted to the work-head, which can then be used for normal dividing operations.

Fig. 13 shows a horizontal machine set up with an attachment for milling worms by means of a disc-type cutter. The right-angle spindle head is clamped to the machine column and driven from the main spindle, and an outboard support bearing is provided for the cutter spindle. Rotation of the work at the required speed is effected by change gears from the table lead screw.

In addition, the company make a bevel gear milling attachment for gears up to 7 in. diameter, which can also be used on a shaping machine, and a fully-automatic indexing attachment for use on milling machines. The latter incorporates a cam mechanism for the traverse motion and is fitted with a workhead arranged to swivel to either a horizontal or a vertical position. A tailstock is provided to support horizontal work mandrels, and the attachment can be used for milling spur and bevel gears, ratchet wheels, and clutch members, for example. A work unit incorporating a 17-in. diameter horizontal indexing table is also available, which gives numbers of divisions from 20 to 480.

Attention may be drawn to a high-speed milling head which the company has introduced for carrying out die sinking operations. Handwheels with graduated collars permit both rotary and cross movements to be applied to the spindle head, which, in conjunction with the table and knee traverse motions, permit either male or female die forms to be produced. Six spindle speeds from 450 to 3,500 r.p.m. are available, and the vertical stroke of the spindle quill is $1\frac{3}{16}$ in. The maximum circle of rotation for the cutter head is $5\frac{1}{2}$ in. diameter.

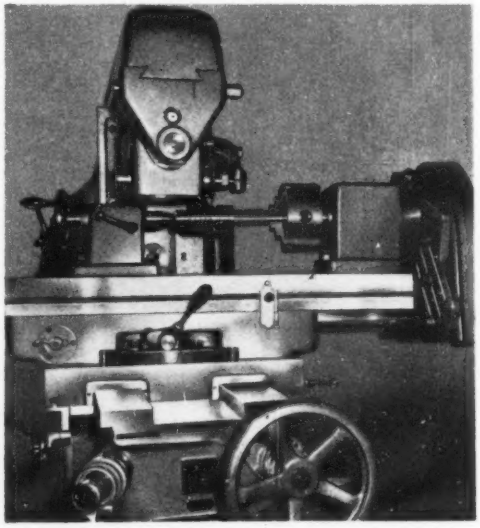


Fig. 13. Application of an attachment for milling worms on a Rigiva horizontal milling machine by means of a disc-type cutter

FEDERICI ULTRAELECTRIC COMBINED ULTRASONIC AND SPARK EROSION EQUIPMENT

Apparecchi Scientifici Federici, Milan (Airmec, Ltd., High Wycombe), who specialize in the fields

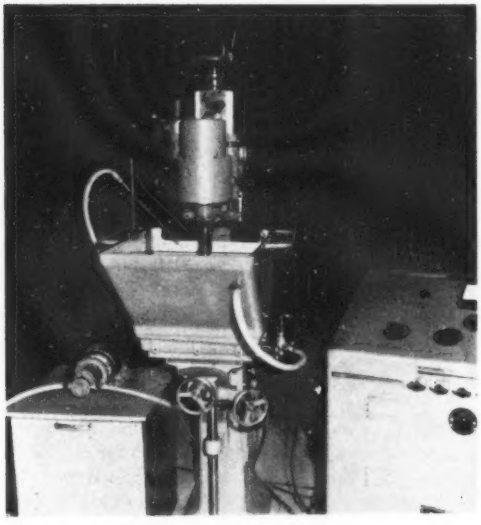


Fig. 14. Ultraelectric machine which combines the techniques of ultrasonic and spark-erosion machining

of ultrasonics and spark erosion, have developed a unit, shown in Fig. 14, which combines the principles of ultrasonic and spark-erosion machining and is claimed to afford a number of important advantages for operations on large workpieces of conducting and non-conducting materials. The Ultraelectric generator, seen at the right of the machine, enables ultrasonic and spark-erosion techniques to be employed in combination or separately, using the one electrode head on the machine, which incorporates both the transducer and electronic servo-feed mechanism.

Generator size is determined by the type of work required and a range providing output power from 750 W. to 6 kW. is available. Special electronic circuits of patented design provide ultrasonic vibrations to the spark electrode to permit work to be carried out almost by impact. The combination of spark erosion, which provides for rapid removal of material, and ultrasonic vibration applied through the transducer to the soft metal tool, is said to result in a very high degree of surface finish and accuracy of form.

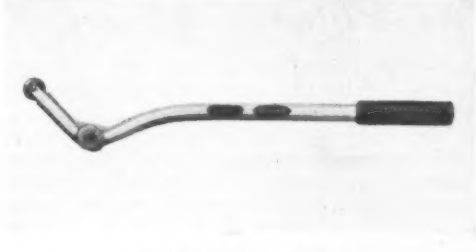
It is stated that through holes of 10 to 20 mm. diameter (0·4 to 0·78 in.) have been machined in material 30 to 40 mm. thick (1·18 to 1·57 in.) at a removal rate of 1·2 to 1·8 cu. in. per 10 hours. Work table and column units can be supplied to suit customers' requirements, and may be of the pillar type as shown, or arranged for bench mounting. Heavy-duty column and table units designed to take large workpieces can also be provided which may be arranged with servo-feed for the longitudinal and transverse movements, and form machining operations can then be carried out by traversing the work.

Other products of the company include ultrasonic drilling units from 800 to 3,200 watts rating, ultrasonic cleaning equipment, soldering equipment, and a wide range of instruments for the non-destructive examination of materials and for chemical and metallurgical processing.

Reliance Roller Pry Bar

The provisionally-patented Reliance roller pry bar here shown, has recently been introduced by Coley Bros. (Tools), Ltd., Birmingham Factory Centre, King's Norton, Birmingham, 30, and may be used, among other applications, for raising punch assemblies from the dies of press tools.

Available in 24-, 36- and 48-in. sizes, the pry bar incorporates a pair of freely-rotating rollers at the fulcrum, and a single roller at its left-hand end which makes contact with the punch assembly to be raised. With this arrangement, an unusually high thrust can be applied upwards to the punch assembly by downward movement of the bar, the right-hand end of which is fitted with a rubber hand grip. In consequence, punch assemblies of press tools up to the fairly large sizes can be raised by one man, using a pair of pry bars. Since only the rollers make contact with the punch assembly and die, the marking of machined surfaces is avoided. Heavy punch assemblies of very large press tools can be lifted by two operators, each using a 36- or 48-in. pry bar.



Reliance roller pry bar

New Techniques for Grinding Sintered Carbides

By E. ZMIHORSKI, M.Sc.

The problems associated with the grinding of sintered carbide, either in the form of cutting tools or tips, by means of silicon carbide, corundum, or diamond wheels, are well known, and such operations may involve high costs, also the possibility of craze cracking of the surface being ground. In this connection, moreover, it may be noted that the rapid rate at which the expensive grinding wheels are worn when operating on this type of material often accounts for a considerable proportion of the overall costs. In an attempt to alleviate some of these problems, experiments have recently been carried out with two new techniques, one of which is intended for rough grinding and high metal removal rates, and the other for finish grinding, carbides. The first method involves raising the temperature of the part to be ground to within 750 to 850 deg. C., and maintaining it at this temperature during grinding. It has been found that at this temperature the sintered carbides are considerably less brittle, and, consequently, less prone to craze cracking. Moreover, the hardness of the material is reduced to a point at which satisfactory results can be obtained by the use of corundum wheels, in contrast to more expensive types. In addition, important reductions in the times required to complete the grinding operations have been obtained as compared with those for conventional " low temperature " grinding.

From practical metal cutting experiments which have been carried out it has been noted that, for an average of four hours cutting time, a lathe tool which was ground by conventional methods could be operated at approximately 470 ft. per min. surface speed, whereas a similar tool which had been ground by the new high-temperature technique could be used at a cutting speed of 555 ft. per min. Other investigations have shown that with high-temperature grinding, the efficiency of cutting tools can be increased by as much as 280 per cent.

High-temperature grinding has been found to offer the greatest advantages when reclaiming tools which have suffered severe wear on the edges, with associated cracks and fractures, from which large amounts of material must be removed. The cost of re-grinding such tools by conventional methods may be so great as to be prohibitive, owing to the time required to remove the damaged portions and the high rate of wear of the wheels. In one instance, a heavy-duty carbide-tipped lathe tool having a 5-mm. long fracture in the carbide tip was rough-ground by the high-temperature method in 30 sec., using a standard red aluminium oxide wheel of 26 grain size and 1 hardness, which was very much less than the estimated time for reclaiming a similarly damaged tool by the normal low-temperature method. According to the grade of the carbide, tests have shown that, for rough-grinding, metal removal rates may vary between 0·183 and 0.366 cu. in. per min.

In theory, if the temperature of a tool is raised to 750 to 850 deg. C. the adhesion between a brazed tip and the shank is likely to be destroyed, but in practice trouble has not been experienced in this connection. When grinding a tool to which the tip has been attached by low melting point brazing alloy, however, it is considered advisable to clamp the tool in the manner indicated in Fig. 1. This 2-point clamp secures both the shank and the tip, and the recommended ratio for the distances of the contact points on either side of the clamping screw is 15 to 1.

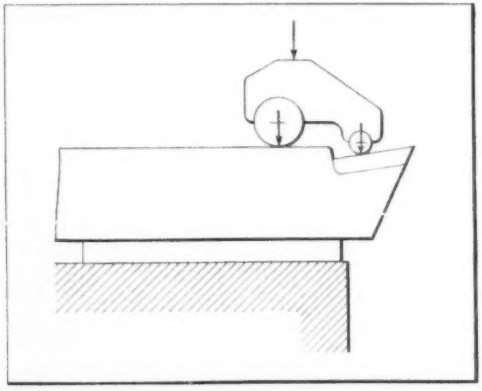


Fig. 1. When grinding a brazed carbide-tipped tool by the high-temperature technique a clamp of the type here shown may be employed, so that both the shank and the tip are securely held

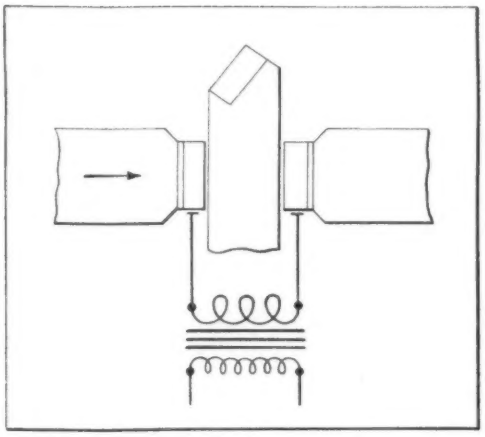


Fig. 2. Preferably, the heating equipment for raising the tool to the required temperature prior to and during grinding should be incorporated in the machine. This diagram shows a resistance heating set-up with a pair of insulated vice jaws

For certain types of carbide tools, including those of profiled form, the time required for grinding may be comparatively long, and it may then be necessary to make some provision for maintaining the tool at the required temperature, also for avoiding oxidation. To this end, a jet of burning coal gas, without air, can be arranged to play on the surface of the tool, to keep it at the required temperature and provide protection against oxidation.

For most normal tipped lathe tools, however, such supplementary heating is unnecessary, since, owing to the short time required for grinding, the abrasive friction is sufficient to maintain the pre-heat temperature.

The most effective method of preheating the tool prior to grinding is by induction, and equipment for this purpose may be provided on the grinding machine. Alternatively, the tool may be raised to the required temperature in a furnace located adjacent to the grinding machine, or by insulated vice jaws incorporating a resistance-heating arrangement, as shown in Fig. 2. Advantage can also be taken of the heat which is applied to the tool when the tip is brazed in position.

SET-UP FOR HIGH-TEMPERATURE GRINDING

A diagrammatic view of a special machine for the high-temperature grinding of sintered carbide is shown in Fig. 3. The tool, as at *A*, is held in a swivelling, tilting vice, mounted on a table which is provided with T-slots in the working surface and arranged for movements in the longitudinal and transverse directions. Horizontal grinding is carried out with the corundum wheel at *B*, which is carried on a head that can be adjusted vertically by means of the handwheel *C*, and grinding in the vertical plane, with the wheel *D*. This wheel is mounted on a head which can be adjusted vertically on a column by means of the handwheel *E*. The wheels *F* and *G* control the transverse and longitudinal movements of the machine table, respectively. It should be noted that owing to the high rates of metal removal which can be obtained in high-temperature grinding, the horse-power of the electric motors used for driving the grinding wheels should be at least twice that required for conventional tool grinding.

As has already been mentioned, the high-temperature grinding technique results in a considerable reduction in the amount of grinding wheel wear, and apart from the economic advantages thus gained, there is a corresponding improvement in working conditions, since the amount of dust formed is proportionately reduced.

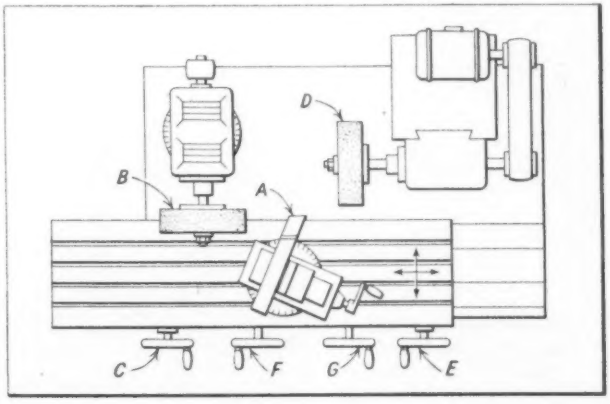


Fig. 3. Diagrammatic plan view of a special machine for grinding carbide-tipped tools by the high-temperature technique. There are two corundum wheels, at *B* and *D*, which are used for grinding in the horizontal and vertical planes respectively

FINISH GRINDING TECHNIQUE

The grinding technique just described is intended mainly for roughing operations, or where large amounts of stock must be removed, for example, to reclaim a badly-damaged tip. For finish grinding, an electrolytic process has been developed which involves the use of special silicon carbide or corundum grinding wheels with a metal bond. To manufacture these wheels, the abrasive grains are sintered with iron powder, the ratio of the two materials varying between 1 to 1 and 1 to 3, by weight. A D.C. electric circuit is set up between the workpiece (anode) and the grinding wheel (cathode) by a continuous flow of sodium silicate solution having a specific gravity of approximately 1·35 kg. per cu. dcm. This solution carries a current of the order of 24 volts, and an amperage of approximately 40 per sq. cm. of electrode area. The speed of the wheel varies between 2,750 and 3,500 ft. per min., and the pressure per unit area on the wheel during grinding is of the order of 8 to 10 kg. per cu. cm.

In operation, the electric current serves to heat the particles of metal to be removed and facilitates the work of the grinding wheel. Tests carried out with this method have produced ground surfaces with a surface roughness of 0·15 μ at metal removal rates up to 0·0025 cu. in. per min. Parts ground in this manner have a high surface finish, and show no signs of craze cracking. The absence of craze cracking suggests that this technique may be of considerable value for grinding such components as hardened gear teeth, ball bearing races, and high-speed spindles, for example. The longer life obtainable from the metal-bonded wheel, and the reduced cost, as compared with diamond wheels for instance, suggests that it may be economic to use the process for high-quantity production work, although it must be borne in mind that special grinding machines will have to be designed to enable the technique to be fully exploited.

It may also be noted that the metal bonded wheels have sufficient strength to permit operation at very high peripheral speeds, ranging from 12,000 to 29,500 ft. per min. With such speeds, it is believed, surface finishes of exceptional quality may be obtained, but it will be necessary to provide machines with suitable spindles and bearings before investigations can be carried out.

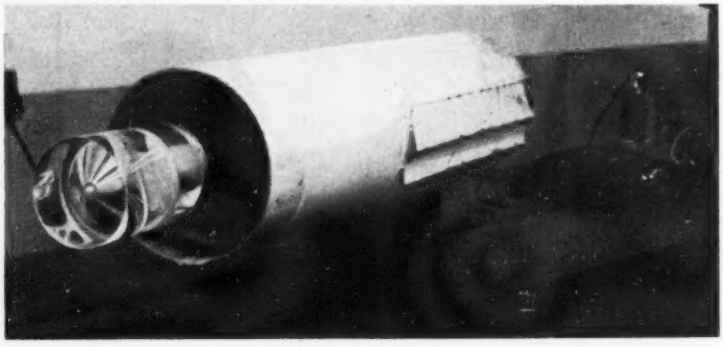
Inspecting the Bores of Long Tubes

The Boeing Airplane Co., U.S.A., have recently developed a unit, as shown in the accompanying figure, to facilitate inspection of the bores of refuelling booms, as employed on the KC-135 jet tanker/transport aircraft. This refuelling boom is 25 ft. long, with a bore of about 5½ in.

A Lucite "lens," incorporated in the unit, is about 3 in. diameter by 2½ in. long, and is ground flat at one end and to a 70-deg. inverted conical form at the other. The "lens" is secured to a reflector holding a black light source, and this reflector, in turn, is mounted on a wheeled carriage which can be pulled through the boom. An infinite-focus micro-alignment telescope of 30 × magnification is mounted at one end of the boom and since the "lens" brings all light rays parallel to the line of sight, a 360-deg. panoramic sweep is obtained.

For checking a boom, the walls of the bore are flooded with penetrating oil containing a fluorescent material which lodges in any cracks or other defects in the surface. By means of the black light source, any such defects are then brought into sharp relief. The area illuminated at one time is about 2 in. long, and the unit is traversed through the bore in steps.

It is stated that a similar arrangement can be employed for inspecting components which have bores from ½ in. diameter upwards.



Special Equipment Developed for Inspecting the Bores of Long Tubes

Moore Universal Measuring Machine

The Moore Special Tool Co., Inc., Bridgeport, 7, Conn., U.S.A., who are well known as builders of jig boring and jig grinding machines, have now introduced a measuring machine of high precision which, in addition to incorporating universal features, provides capacity for handling the larger sizes of workpieces. Known as the type No. 3, it is arranged for floor mounting, as seen in the accompanying illustration, and the 11- by 24-in. table has a longitudinal travel of 18 in., and a cross travel of 11 in. A vertical adjustment, by hand, of 17 in. is provided for the spindle housing on the column, and the quill, in which the spindle may rotate or remain stationary, has a travel of 2¼ in. The throat depth of the machine, from spindle centre to column casting, is 13½ in., and to the column ways, 10 in.

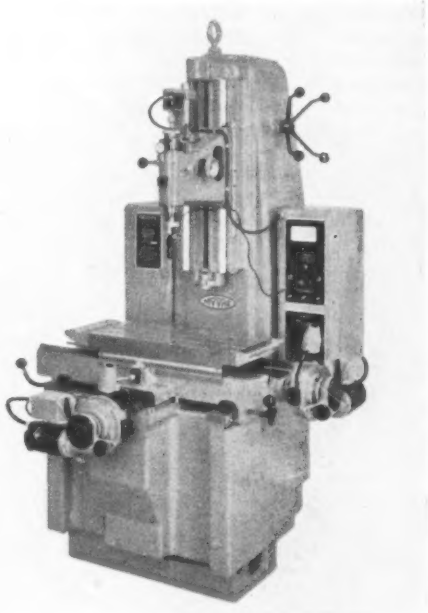
All the guideways are of hardened, ground and lapped steel fitted to hand-scraped seatings on the castings, and they are of prismatic section, which eliminates the need for adjusting gibs. Table positioning in the two directions of travel is accomplished by means of master lead screws fitted with graduated dials and verniers.

Power traverse, by means of built-in motors and reduction gearboxes, can be provided for the table and saddle, if required, as shown in the illustration, this arrangement ensuring the desirable smooth and uniform movement to the setting position. A relatively rapid rate of traverse, for moving the table or saddle to approximately the required position, is engaged by means of a selector switch on the panel mounted on the right of the machine column, and a slower rate is then brought into use by moving 2-position selector switches on control boxes adjacent to the traverse motors. This slower rate enables the operator to observe the table position with reference to rules graduated in $\frac{1}{10}$-in. divisions.

The second position of the selector provides a slow traverse rate which permits the readings on the lead-screw micrometer dials to be observed, and when the table is within about 0·001 in. of the required position the power traverse is disengaged and final adjustment is made by rotating a small knob on the lead-screw gearbox, the latter providing a reduction ratio of 100 to 1. Scale reading is facilitated by an illuminated magnifier which is located above the dials.

In the building of the Moore jig boring and jig grinding machines the company have gained considerable experience in the production of precision lead screws, and the master screws incorporated in this new No. 3 measuring machine represent a notable achievement. No corrector devices are employed in the system, and the lead screws run in solid nuts of aluminium bronze.

The screws are made of stabilised Nitralloy 135 steel, heat treated to produce a tough core, and hardened to Rockwell 70C. for a depth of 0·020 in. After the 29-deg. Acme threads have been finish ground, the screw is checked against a master lead-screw, which traverses a carriage mounting an electronic stylus gauge. The latter engages the pitch line of the screw being checked, which is directly coupled to the master screw and thus rotates in unison with it. A chart record is taken and errors at any part of the screw are then corrected by specially-developed hand lapping methods. The threads of the 2-in. long nut are produced by progressive tapping operations, and



Universal measuring machine introduced by the Moore Special Tool Co., Inc. For setting of the 11- by 24-in. table, lead screws of high precision are employed

the nut and mating screw are then run together for burnishing, using paraffin as a coolant, and a full bearing is thus obtained over the flanks of all the threads. One of the tests to which the finished screw and nut assembly is subjected involves rotating the screw relatively slowly, with the unbalanced nut in free engagement, and checking that the angle through which the nut is swung, by frictional contact between the threads, remains constant, within prescribed limits, as it moves along the screw. Signals obtained from electrical contacts, indicate the limits of swing allowed, and the test is repeated with the nut reversed on the screw.

With these screws and nuts, the error in any one inch of longitudinal or cross travel of the table is guaranteed not to exceed 0·000015 in. (15 millionths), and the maximum error in the total longitudinal or cross movement is within 0·000035 in. Squareness of the compound table movements for a 10 by 10 in. travel is stated to be within 0·00002 in., corresponding to one sec. of arc, and the straightness of longitudinal travel, vertically and horizontally, over the length of 18 in., is within 0·000025 in. Straightness of cross travel, over 11 in., is within 0·000015 in. The travel of the spindle is square to the table within 0·00003 in., and the spindle housing travel is square within 0·00005 in. Spindle rotation is true to 0·000005 in. (5 millionths), which enables the machine to be employed for checking roundness. The spindle rotates in some 400 specially-selected balls of a close-tolerance grade, which are retained in a cage and provide an interference fit of about 0·00015 in. between the spindle and the bore of the quill. Axial movement is eliminated by means of a preloaded ball thrust bearing also incorporating selected balls. The bearings are grease filled for life and lubricant seals are fitted to exclude dirt. Drive to the spindle is provided by means of a small motor directly coupled from above, which is supported on a bracket moving up and down with the spindle quill.

Each of the 500 graduations on the leadscrew dial represents 0·0002 in., and the vernier reads to 0·00002 in. The settings, it is stated, can be repeated to an accuracy of 0·00001 in. (10 millionths).

Measurement can be carried out by the use of either a universal microscope or an electronic stylus indicator mounted in the spindle, the indicator and associated electronic control panel being seen fitted in the illustration. This equipment is supplied by the Cleveland Instrument Co., U.S.A., and the stylus unit, which is of a specially-developed, compact design, will enter, bodily, holes of fairly small diameter, to enable measurements to be taken at considerable depths. The stylus mounting arm provides a measuring capacity of 10 in. diameter, and the range can be increased by fitting an extension piece. A selector switch on the panel enables the scale reading of the meter to be changed from 0·0001 in. to 0·00001 in. per division, and, if required, a greater ratio of amplification can be provided, for example, 0·000002 in. per division. Sockets in the panel enable a chart recorder to be plugged in. The pressure of the stylus is very small, ranging from $\frac{1}{16}$ to $\frac{1}{4}$ oz. If desired, the stylus head can be removed from the spindle and attached to a machined face on the front of the spindle housing. There is also an abutment on the housing for locating slip gauges, which are used in conjunction with a dial indicator on the spindle quill, for making depth settings.

Accessories available include the Moore No. 2 rotary table which reads to one sec. of arc, and the No. 2 Micro-Sine tilting table.

Development of this measuring machine was begun some eight years ago, after Moore jig borers, without power traverse and spindle drives, had been purchased by several well-known firms in the U.S.A., to be used for measuring purposes. Very careful preparation was made at the outset, to ensure that the new machine should have a degree of accuracy adequate for the purpose. For checking of the table and cross-slide movements imparted by the lead screws, an 18-in. long master step gauge, of 1-in. step spacing, is employed in conjunction with an electronic stylus head. This step gauge was produced to an accuracy of 2 millionths of an inch, with reference to 18-in. master length bars, and it is of interest to note that, to provide a comparison check for accuracy, three 18-in. length bars, obtained from entirely different sources, were employed. One of these bars was produced in this country by the Coventry Gauge & Tool Co., Ltd., and checked by the National Physical Laboratory, and a second bar was made by the German firm of Hommelwerke. The third length bar was produced in the U.S.A., and checked by the National Bureau of Standards in Washington. In addition, a line standard produced by Hilger & Watts, Ltd., in collaboration with the N.P.L., is being used by the company.

The sole agents for the Moore Special Tool Co., Inc., in this country are Catmur Machine Tool Corporation, Ltd., 103 Lancaster Road, Ladbroke Grove, London, W.11.

EXPORTS OF MACHINERY (except electrical) from the Federal Republic of Germany during the first half of this year averaged D.M. 638·97 million per month. For the full year 1957 the average was D.M. 611·24 million.

Atlas Works of W. H. Allen Sons & Co., Ltd.

W. H. Allen Sons & Co., Ltd., acquired Atlas Works, Pershore, Worcs., in 1955, and have since installed many new machine tools of different types, including gear cutting machines which have been transferred from their main works at Bedford, to provide increased capacity for the production of Allen-Stoeckicht epicyclic gears, and parallel-shaft reduction gear boxes for marine and power station generators. These works, which were formally opened recently by Admiral Sir William Tennant, K.C.B., C.B.E., M.V.O., Lord Lieutenant of Worcestershire, are now in full operation, and are devoted entirely to the production of such gears.

Of cruciform shape, the works comprise a machine shop, which extends for the full length of two "arms," a gear cutting shop, and an assembly department and test bay. Works offices, inspection departments, and tool and finished parts stores are located at the centre of the cruciform. Although no major structural alterations have been made to the buildings since they were acquired by the company, wood block floors, and gangways of granolithic material have been laid throughout, and a new boiler house and heating system, also a new transformer room have been built. In addition, a loading bay has been provided, which has doors at each end to prevent wide temperature variations in the adjacent part of the machine shop, while loading and unloading of lorries is being carried out.

In the machine shop, heavy-duty machines are grouped in the central bay at one end, as shown in Fig. 1, and an overhead crane is provided to facilitate work handling. Machines in this section include a Lumsden 100-in. diameter rotary-table surface grinder, which is employed for machining the joint faces of gear boxes, and obviates the need for a planer. There is also an electric annealing furnace for the stress relieving of workpieces with dimensions up to a 4-ft. cube. Light- and medium-duty machines, including centre and capstan lathes, milling machines, internal and external grinders, and borers, are installed in side bays at the other end of the shop, and separate electric hoists are provided for the loading and unloading of workpieces. In addition, there are two Avery electro-magnetic dynamic balancing machines, each of which has a capacity for handling components of weights up to 600 lb. It may be mentioned that coolant is supplied to nearly all the metal cutting machines in the shop by a centralized system.

Fig. 2 is a general view of the gear cutting shop, which occupies the southern arm of the cruciform. The largest gear hobber here installed is a 72-in. capacity David Brown Muir machine, which will cut gears to grade A limits. It is proposed to build an enclosure for this machine in order to provide closer control of the working temperature than is at present obtainable. Double

Fig. 1. A view of the machine shop at the Pershore works of W. H. Allen Sons & Co., Ltd.

Fig. 2. A general view of the gear cutting shop. The Hydroptic 7 jig borer seen in the foreground is employed for precision boring and milling on a production basis

helical annulus gears and sun and planet wheels for the Allen-Stoeckicht epicyclic units are produced to a very high degree of accuracy on two Sykes 3C gear shapers, which were built to conform to the company's own specification, and provide for the cutting of both helices simultaneously. Other equipment installed in the shop includes gear shavers, two Maag gear grinders (Burton Griffiths & Co., Ltd.) and the Hydroptic 7 jig borer (Société Genevoise, Ltd.) seen in the foreground, which is employed for production purposes for the boring of planet wheel carriers, also high-accuracy boring and milling operations on other precision components.

All gears produced in this shop are closely checked in an adjacent well-equipped gear inspection department, and records are maintained which indicate the composition and hardness of the material used for each component, and give details of tooth profile, helix angle, pitch accuracy, and hardness after heat treatment of the finished product. Equipment provided for carrying out this work includes two Maag type PH.60 involute testers, Goulder No. 2 and No. 4 rolling gear testers, and a Hilger projector.

Gears for the epicyclic units are nitrided after they have been shaved, and no subsequent operation is performed, with the exception of honing the bores of planet wheels. Nitriding equipment for the treatment of gears up to 20 in. diameter, and plant for lining bearings and facing journals on planet wheel spindles with white metal is housed in a separate building.

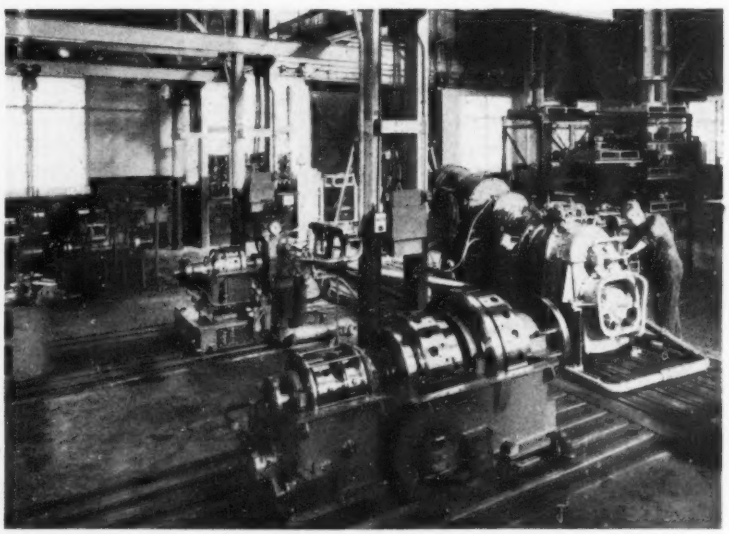


Fig. 3. Some examples of Allen-Stoeckicht epicyclic gears may be seen in this general view of the test bay

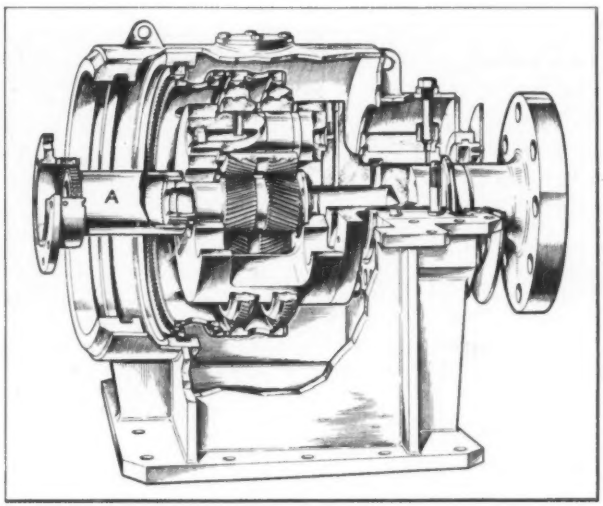


Fig. 4. A cut-away view of an Allen-Stoeckicht epicyclic gear

The northern arm of the cruciform houses the fitting and assembly departments, and the testing bay, a view of which is given in Fig. 3. D.C. driving motors with Ward-Leonard control are provided for running the gear units at steplessly-variable speeds for testing purposes, and a small-capacity, high-speed, water brake is available for applying light loads to the gears during tests. In the foreground may be seen an Allen-Stoeckicht 2-speed, double-reduction epicyclic gear for a mine tunnelling machine. Capable of transmitting a maximum of 110,000 lb.-ft. torque, this gear box is intended for use with a 160-h.p. motor, to provide speeds at the output shaft of 24, 18, 12 and 9 r.p.m. It will give an overall speed reduction ratio slightly exceeding 80 to 1, and the largest annulus gear which is incorporated has a diameter of 30 in. The unit is 6 ft. long overall, and weighs 5½ tons.

DESIGN FEATURES OF ALLEN-STOECKICHT GEARS

Allen-Stoeckicht epicyclic gear units are made by the company under licence from Germany for both speed reduction and speed increasing duties, in a wide range of sizes with capacities for transmitting from about 10 to more than 10,000 h.p., to provide shaft speeds from a few revolutions per min. to 45,000. A gear unit at present being built is destined for Canada, and will form part of an 11,000 h.p. motor driven compressor plant. Other gears have been supplied by the company for power station and marine main propulsion and generator drives.

As already indicated, the gears are of the double helical type, and from Fig. 4, which shows a cut-away view of a typical single-stage epicyclic unit, it will be noted that the sun wheel shaft has no bearings but is supported by the planet wheels. It is connected to the high-speed shaft, whereby the drive is transmitted to the unit, by gear-type couplings and the sleeve A. Separate helical annulus gears, of opposite hand, mesh with the planet wheels, and are housed in a ring which, in turn, is supported in the body by a second ring. These rings are connected to each other and to the annulus gears and the body by gear-type couplings, and end thrust is taken by ring clips. This arrangement provides a degree of flexibility which ensures that uniform contact pressure is obtained between each planet wheel and the sun and annulus gears. In consequence, equal loads are transmitted by all the planet gears when the unit is in operation. Another feature of the design is that, since the sun wheel shaft and planet wheels can move freely, endwise balanced loading is obtained on the two portions of the helical gears.

POLYTHENE PACKAGING APPLICATIONS—Portable pneumatic and electric tools, also their associated spares, manufactured by Desoutter Brothers, Ltd., are now being packed and sealed for despatch or storage in polythene bags supplied by Spesco Developments, Ltd., Chertsey, Surrey. The bags, of which 14 different sizes are used, have a printed panel on one side, and since the material is transparent the need for attaching identifying labels has been eliminated. The users have installed a heat sealing machine in their despatch department, to close the open ends of the bags, and it is stated that the overall packaging time for these items has been reduced by 50 per cent, compared with the previous method which involved wrapping them in heavily-impregnated grease-proof paper.

Polythene is also being used for packaging purposes by The de Havilland Aircraft Co., Ltd., Hatfield, and in this instance the material is supplied by Spesco Developments, Ltd., in tubular form, wound on to a reel. The user company's name and trade mark is printed at regular intervals along the tube, which is cut to length to suit individual components and, finally, heat sealed at each end.

Dawson Universal Milling Arbor

Edward Dawson (Engineers), Ltd., Church Avenue, Sawley, near Long Eaton, Nottingnam, have recently introduced a patented universal milling arbor (world patents pending) known as the Uni-Arbor. This equipment enables practically any standard cutter, or combination of cutters, to be rapidly set-up or changed, on all types of machines provided with any of the standard spindle nose tapers, including horizontal and vertical milling machines, horizontal borers, and tool and cutter grinders. Among tools that can be set-up in this way may be mentioned drills, reamers, face mills, end mills and shell mills, and complete cutter gangs for horizontal milling. The versatility of the equipment is, in fact, such that, on a horizontal milling machine, for example, a complete machining sequence can often be carried out, with the work in the same setting throughout. Cutter-changing, in any desired order, can be effected in 30 to 60 sec. or less, according to the nature of the set-up.

Some examples from the range of simple interchangeable components which form the basis of the Uni-Arbor system are shown in Fig. 1. The "base-arbor" *A* normally remains in the spindle nose, to which a pair of dogs is attached by means of screws. These dogs project through the slots *B* in the base-arbor, and prevent it from rotating in the spindle nose taper. The various cutters are mounted in the base-arbor by means of interchangeable "inserts," examples of which are seen at *C*, *D* and *E*. When a large heavy-duty facing cutter is required, it is mounted on the parallel spigot seen projecting from the base-arbor, and the dogs on the spindle nose engage slots in the cutter body. An insert with an integral collar, and a shank that accurately fits the bore of the base-arbor, is inserted in the latter, and tightened through a drawbar system, by means of a nut at the opposite end of the spindle, to secure the cutter.

A cutter with a bore-diameter smaller than the base-arbor spigot is mounted by means of an insert with a locating diameter that fits the cutter bore, and a double-sided dog-type driver is interposed between the cutter and the base-arbor spigot. The dogs on one face engage the slots in the cutter, and those on the other side, the slots *F* in the base-arbor spigot. Three typical drivers are seen towards the bottom right in Fig. 1. By employing a suitable insert, the cutter set-up can be "compounded," by mounting one cutter on the base-arbor spigot, and one or more on the locating diameter of the insert, with drivers interposed. All inserts are ground accurately concentric, within 0·0003 to 0·0005 in., total indicator reading.

The range of inserts includes both solid and hollow types, and examples of the latter are seen at *D* and *E*. These hollow inserts are designed to hold standard taper-shank tools such as drills, reamers, end mills, and shell reamers, and are available with cutter-locating

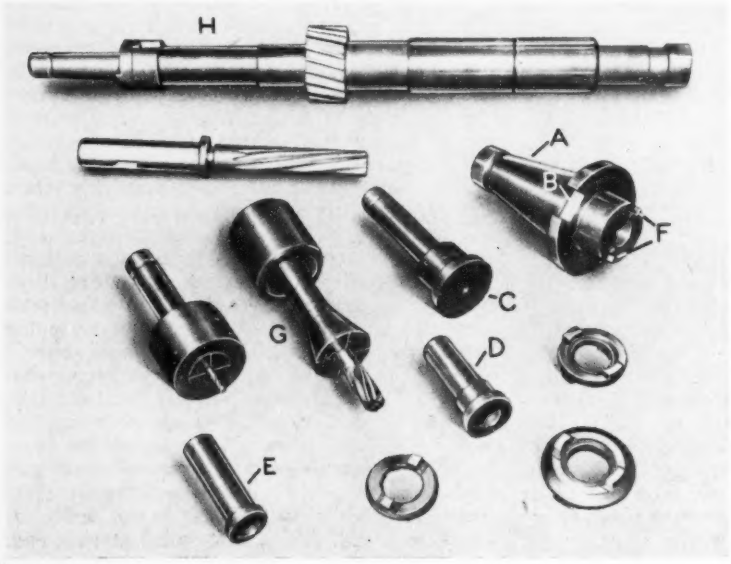


Fig. 1. Simple interchangeable components of the type here illustrated form the basis of the Uni-Arbor system

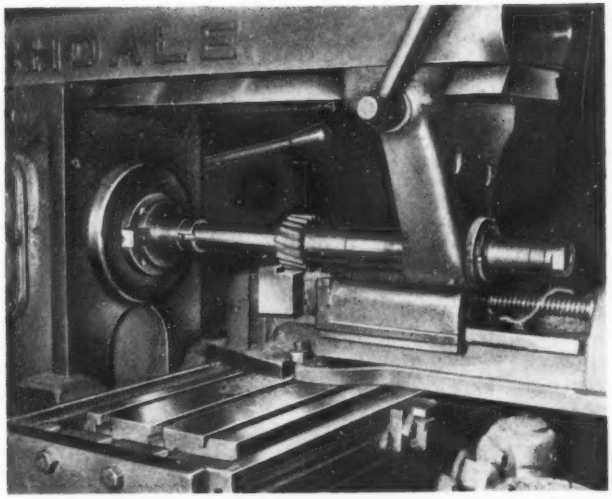


Fig. 2. Typical set-up on a horizontal milling machine, utilizing the arbor seen at *H* in Fig. 1

diameters. The example *D* is of the latter type, and by employing inserts of this design, taper-shank tools may be incorporated in "compound" set-ups. Provision is made for mounting parallel-shank tools by means of adapters and split collets, as seen at *G*. The adapter is counterbored at the rear end, for accurate location on the base-arbor spigot, and the opposite end has a conical bore to suit the collet. These collets, which can also be incorporated in compound set-ups, are tightened by the drawbar system used for securing the inserts, and are available in various sizes, for cutters down to $\frac{3}{16}$ in. diameter.

For more conventional set-ups on horizontal milling machines, for example, for gang milling, arbors of the type seen at *H* are available in sizes ranging from 1 in. to 2 in. diameter. These arbors are, in all respects, equivalent to the standard type, except that the shank portions are similar to those of the inserts. A cutter-gang can thus be mounted on an arbor of this type, and set-up on the machine, or removed from it, as a single unit, without the necessity for releasing the clamping nut or disturbing the spacing collars. Repeatability of a high order is ensured, and advantage may also be taken of this feature by regrinding certain types of

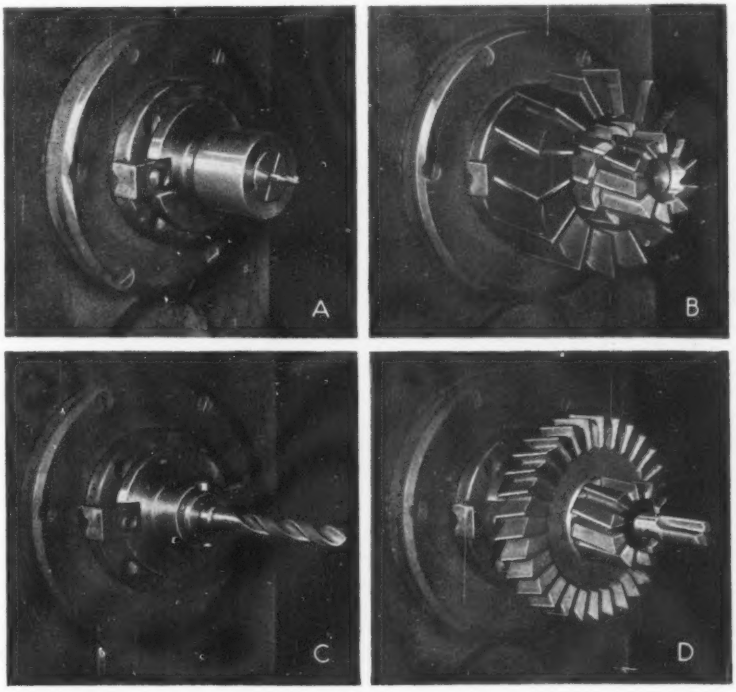


Fig. 3. Typical cutter set-ups that can be obtained on a horizontal milling machine. *A*—$\frac{3}{16}$-in. diameter end mill in collet and adapter; *B*—compound assembly of a large face mill and two smaller cutters; *C*—drill, held in a hollow insert; *D*—compound set-up incorporating a slotting cutter

cutters without removing them from the arbor. Similarly, other types of cutters can be ground on the inserts used for setting them up on the machine, so that high accuracy for squareness and concentricity is obtained. A typical set-up, utilizing the arbor seen at *H*, is shown in Fig. 2. Boring bars, designed for mounting in the base-arbor in the same manner, are also available.

A series of illustrations, showing some of the various ways in which the Uni-Arbor can be employed on a horizontal milling machine, is given in Fig. 3. At *A* is seen a $\frac{3}{8}$-in. diameter end-mill set-up in a collet and adapter, and *B* shows a compound set-up comprising a large face mill, and two additional cutters, clamped by a solid insert.

The application of a hollow insert, for holding a drill, is illustrated at *C*, and *D* is a typical compound set-up, also with a hollow insert comprising a shell end mill, a slotting cutter, and a side and face cutter. For set-ups of this type, it may be noted, inserts with adjustable screw collars are available, for controlling the slot-depth/face relationship.

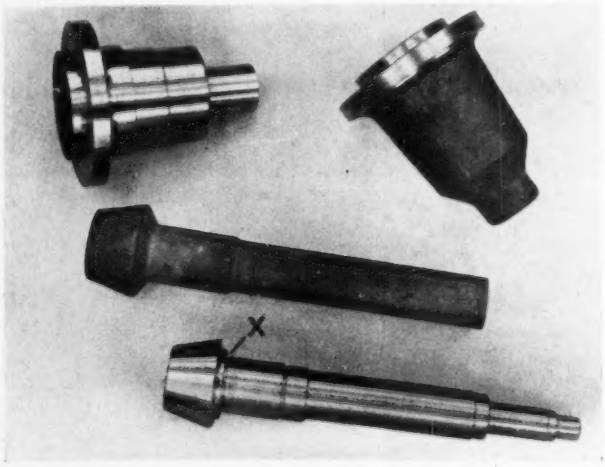
In certain respects, the Dawson Uni-Arbor resembles the Stieber type 333 arbor, produced by Stieber & Nebelmann, Munich, in which the insert is retained and locked by means of a socket-head screw, at the front of the assembly. An agreement was recently made between the two companies, under which Edward Dawson (Engineers), Ltd., will produce the Stieber 333 arbor in this country, and Stieber & Nebelmann will produce the Uni-Arbor in Germany, on a reciprocal basis.

Birfield Tools, Ltd., Bodmin Road, Coventry have been appointed sole selling agents for the above equipment.

Profile-turning Bevel Pinion Shafts

A description of the C-R type P.5 multi-tool and profiling lathe recently developed by Churchill-Redman, Ltd., Parkinson Lane, Halifax, was published in MACHINERY, 92/570—7/3/58, and subsequent reference was made to this machine when it was demonstrated at the Birmingham showrooms of the distributors, Charles Churchill & Co., Ltd. (MACHINERY, 93/624—10/9/58).

The accompanying illustration shows two components which were machined on lathes of this type at another recent demonstration held at the Halifax works. For the bevel pinion shafts, of En. 34 steel, two set-ups were employed, and at the first stage, the head of the forging was held in a 3-jaw chuck and the opposite end was supported by a tailstock centre. The shaft portion and the rear of the head were profile-turned, three cuts being taken at the small diameter end. When the copying tool reached the point *X* during the third pass the speed was automatically reduced from 1,200 to 600 r.p.m. At this point, also, the rear auxiliary slide was advanced to produce two of the relief grooves in the shaft. The feed rate for this stage was 0·014 in. per rev., and the cycle time for the first set-up, 1 min. 40 sec.



Components machined at a recent demonstration of Churchill-Redman type P.5 multi-tool and profiling lathes

For the second set-up, the component was reversed and the small diameter end was inserted in a sleeve which provided for axial positioning from a shoulder. A spring-loaded centre was employed in conjunction with this sleeve, and the chuck jaws were applied to the work through equally-spaced holes in the sleeve walls. With this set-up a single copy-turning cut was taken over the taper surface of the head at a speed of 600 r.p.m. and a rate of feed of 0·014 in. per rev.

In addition, the remaining relief grooves were cut by tools in the rear auxiliary slide at a feed rate of 0·005 in. per rev. This second stage was completed in a cycle time of 45 sec.

The Engineering Department of the Mullard Radio Valve Co., Ltd.

The Engineering Department of the Mullard Radio Valve Co., Ltd., at Mitcham, Surrey, was formed very early in the firm's history, since it has always been the policy to undertake the design, development, and construction of special plant required for production purposes within the organization. Briefly, the functions of the Department can be defined as the design and construction of new plant for the production of valves, transistors (and other semi-conductor components), television and instrument tubes, X-ray tubes, and magnetic ferrites; the development or modification of existing machines and equipment for adaptation to new processes, also the major overhauling of plant; routine maintenance; and the training of apprentice engineers for such work. The Department at Mitcham caters for that plant, also for the company's factories at Waddon, Whyteleafe, and Hove, and functions in close co-operation with similar Departments in the remaining three main plants in the Mullard organization, namely, the receiving valve plant at Blackburn, the television tube plant at Simonstone, and the transistor plant at Southampton.

The Mitcham Engineering Department provides employment for nearly 300 people and has recently been moved to a new shop, a general view of which is shown in Fig. 1. In the foreground can be seen the lathe section of the toolroom, with the milling section adjoining. Next in line, down the shop, there is a Newall jig borer, and the succeeding sections are devoted to a battery of capstan lathes, for small-batch production work, and to the erection of special purpose machines and equipment. At the far end, are installed a Webster & Bennett vertical boring mill and an Asquith radial drilling machine. At the extreme right, under the first floor, may be seen a corner of the enclosure surrounding the grinding section, and the remainder of the shop on that side is devoted to the production and maintenance of press tools, of which a wide variety are made. These tools, which are made for both hand and power operation, range from simple punching and cropping types, to multi-stage progression tools, for as many as 18 different operations.

In the construction of these press tools, extensive use is made of tungsten carbide inserts, which are spark-eroded on an Eleroda D1 machine (Rockwell Machine Tool Co., Ltd.). Considerable increases in working life of tools have been achieved by incorporating these inserts, and this point is well illustrated by the tool seen in Fig. 2, where a section of the strip is also shown. This tool is employed for blanking the anode seen immediately in front of the strip, which is required in large quantities for five different types of valves. The anode is blanked from nickel iron, 0·005 in. thick by approximately 1½ in. wide, which is annealed,

Fig. 1. General view of the new shop which has been provided recently for the Engineering Department of the Mullard Radio Valve Co., Ltd., Mitcham. The building also houses the design, planning, and purchasing offices

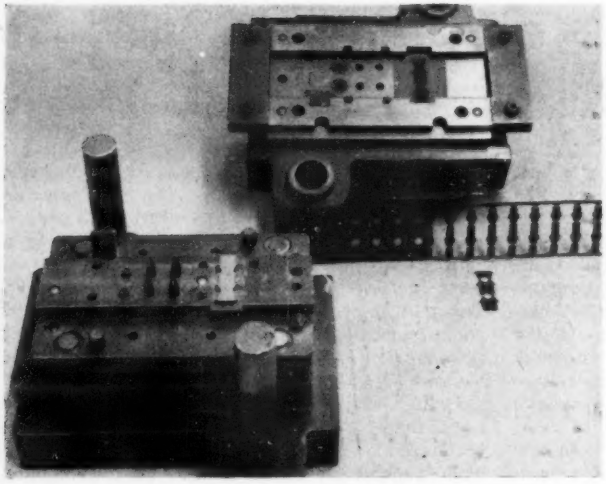


Fig. 2. This press tool is used for blanking anodes from nickel iron strip and incorporates tungsten carbide punches and dies produced by spark-erosion. The tool will blank a complete batch before it requires to be re-serviced

sand blasted and carburized on both sides, and the abrasive properties of this material are such that with the high-speed steel punches and dies originally employed the tool produced only 10,000 parts on the first run before re-servicing was required. During the second run, 5,000 satisfactory parts were blanked, and it was found that for subsequent runs this latter figure was progressively reduced.

With tungsten carbide inserts and punches, however, the complete production requirement of parts per batch can be achieved, without interruption, in one run, and although the tool is re-serviced after this number has been produced, it is believed that a considerably larger number could be blanked before it received attention. At the first stage, a cropping operation is performed on one edge of the strip, and at the next station, two 5-mm. holes are pierced for location purposes. The next three stage are idle, and at the sixth position the component is blanked, as shown.

The blanking punch for this tool was ground on a Wickman Optical Profile grinder, installed in the grinding section, and the die was spark-eroded on the Eleroda machine already mentioned. For this operation, roughing and finishing electrodes were employed, both of K.E. 672 steel (Kayser, Ellison & Co., Ltd.), the time required for roughing the die, which is nominally ¼ in. thick, was 12 hours, and for finishing, 6 hours. Spark-eroded punches and dies are consistently produced within 0·0002 in. of the required size, and a surface roughness of an average of 12 micro-in. is obtained. For certain tools, it is the practice of the company to spark-erode the punch from tungsten carbide, and then to use this punch as an electrode for spark-eroding the die. The punch is made of greater length than is finally required, so that the eroded end can subsequently be removed.

Prominent in the new premises is the drawing office, which hitherto was housed in a department some distance from the toolroom. The new office is exceptionally well designed, to give the best possible working conditions, with ample natural and artificial lighting. Each draughtsman has a Hamburg-size board, mounted on a Nike fully-adjustable hydraulic stand, and equipped with a draughting machine. Adjacent to the drawing office is the printing and filing section, and it is interesting to note that the company is adopting the vertical plan filing system in preference to horizontal filing in plan chests, with substantial savings in floor space. In order to reduce, as much as possible, the time required to produce the drawings for tooling and special equipment it has always been the company's policy to take advantage of the wide range of standardized components which are available from outside sources. To this end, three showcases have been installed at one end of the drawing office in which are displayed such equipment as typical air cylinders, micro-switches, bearings, components for die sets, and a range of the natural and synthetic materials which are available from the rubber and plastic industries, for example. The contents of the cases are added to, and kept up to date from time to time, by the suppliers concerned, and this system has not only proved very convenient as a means of keeping designers in touch with the latest developments, but may permit important savings in the time required to select a suitable item for incorporation in a design, since the need to search through catalogues is reduced or, in some cases, eliminated entirely.

STOCKS OF COAL, distributed and undistributed at the end of September, totalled 34,003,000 tons, compared with 27,912,000 tons 12 months earlier.

British-built McKay Machines

As reported in MACHINERY, 93/914—15/10/58, a new company, known as Vickers-McKay, Ltd., has been formed jointly by the McKay Machine Co., Youngstown, Ohio, U.S.A., Vickers-Armstrongs (Engineers), Ltd., and the Rockwell Machine Tool Co., Ltd., and the range of McKay machines will be made in this country by Vickers-Armstrongs. In addition, the design and construction of equipment for handling, forming, or processing coiled material, to customers' special requirements, will be undertaken.

The McKay Co. supply complete lines for handling coiled material from 24 to 108 in. wide, and the equipment is designed to feed the material at high-speed into either a guillotine or a blanking press. Such a line comprises three inter-connected units arranged to uncoil and feed preset lengths of material. Various types of coil holders are available, and equipment can also be incorporated for washing and cleaning the material. A typical McKay installation was described in MACHINERY, 92/1432—20/6/58, in an article concerned with the new press shop at the works of Vauxhall Motors, Ltd., Luton.

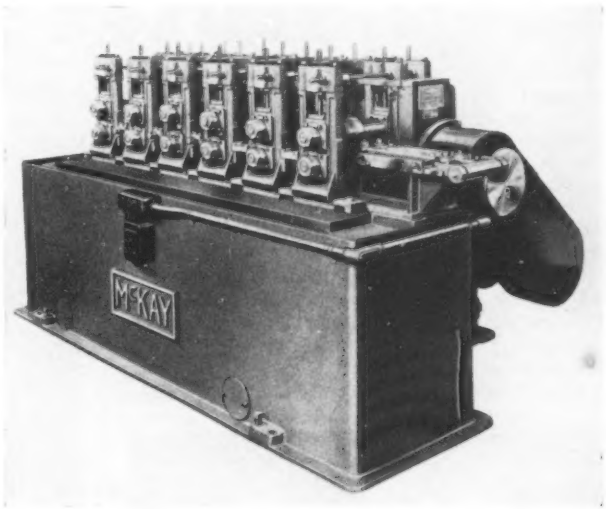


Fig. 1. (below) An example from the range of McKay steel sheet flexing machines being built in this country

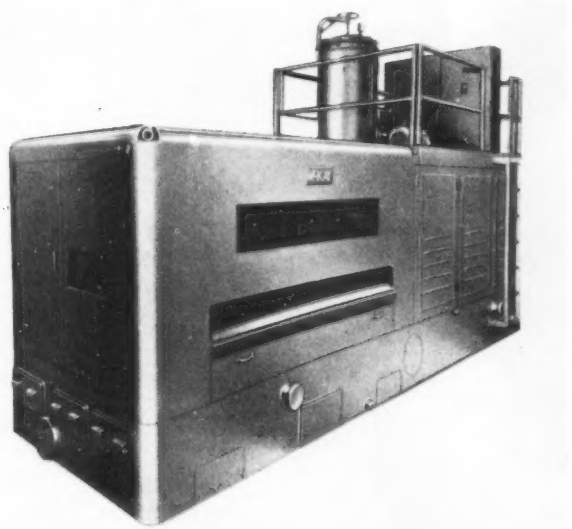


Fig. 2. A McKay strip-forming machine from the range now being built in this country. These machines are suitable for forming flat strip into a wide variety of shapes

In Fig. 1 is shown a typical example from the range of McKay steel sheet flexing machines, which are also to be built in this country. These machines are designed to "temper" sheet steel temporarily by subjecting it to a flexing process, to facilitate the deep drawing of materials which otherwise might not be suitable for such operations. The McKay equipment also includes complete cutting-off lines, incorporating swivelling, flying, or rotary shears, and such lines are available for various widths of material, and thicknesses up to ¼ in.

Ranges of square-tube- and strip-forming machines are to be built, and an example of the latter type of machine is shown in Fig. 2. The machines in this range are suitable for forming flat strip into a wide variety of shapes, and can be employed for a large number of different materials.

Other McKay products include shear and butt-welding machines, for preparing the edges of steel sheets and joining them with a full-width weld. Such machines can be incorporated in a line for continuous processing of sheet steel, and can be operated in conjunction with continuous uncoiling equipment. In addition, there are cutting-off machines for pipes, tubes, and formed sections, and draw benches, for bars and tubes, which can be supplied for operations on a maximum of three workpieces simultaneously. The McKay Co. also build a number of special-purpose machines for bending and profile-rolling motor car wheel rims, together with circling and bending machines for the production of a wide variety of components.

British-built McKay equipment will be marketed in this country by the Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2.

Churchill-Curtis Abrasive-belt Grinding Machines

By arrangement with the Curtis Machine Corporation, Jamestown, U.S.A., and The Carborundum Co., Ltd., Manchester, Churchill Gear Machines, Ltd., Blaydon-on-Tyne, Co. Durham, are now making abrasive-belt grinding machines. Two machines built at Blaydon-on-Tyne are here illustrated, the type 304C being shown in Fig. 1, and the type 600C in Fig. 2.

The former is a conveyor machine for grinding,

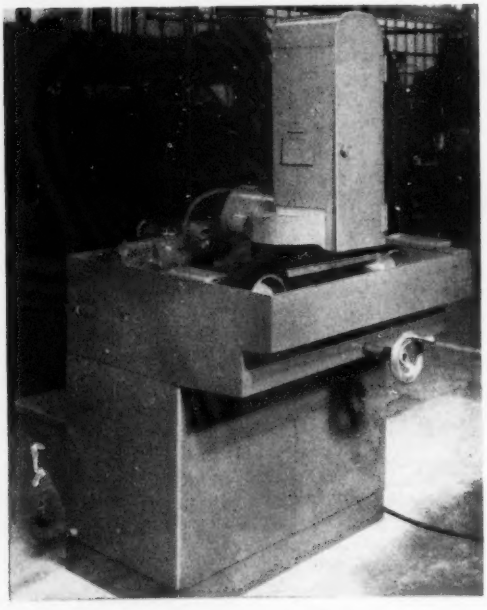


Fig. 1. Churchill-Curtis Type 304C conveyor-type abrasive-belt grinding machine

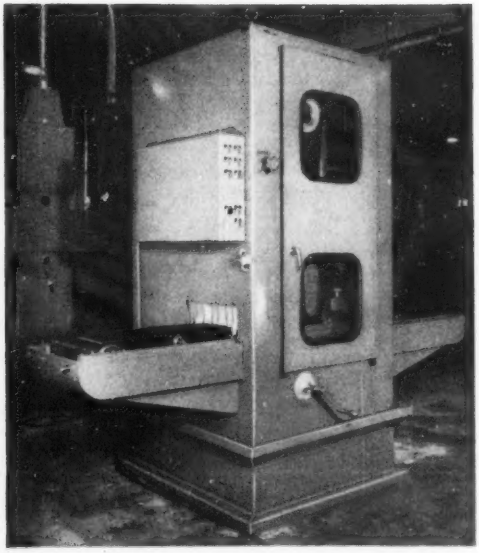


Fig. 2. Churchill-Curtis Type 600C conveyor-type abrasive-belt grinding machine

polishing and deburring work up to 4 in. wide by 2½ in. thick. It can be supplied as a bench unit, for dry grinding, or can be mounted on a sheet-metal pedestal, and equipped with suds pump and piping for wet grinding, as shown. Designed for high output, the machine will grind ferrous and non-ferrous metals, also plastics, stone, wood, glass and other materials. Precision adjustments facilitate rapid change over from one job to another, and a magnetic work-holding fixture is available, if required, for iron and steel com-

ponents. Units can be arranged in series to perform multiple grinding and polishing operations with only one handling of the components.

On the larger, 600C, machine, which has similar features, the work capacity is 10 in. wide by 4 in. thick for bars, blanks and other parts. The unit is completely enclosed and all controls are easily accessible.

Charles Churchill & Co., Ltd., Coventry Road, Birmingham 25, are the sole distributors of these machines.

G.I.E.C. Activities

Since the Gloucestershire Industrial Education Council began its activities on a small scale just over 3½ years ago, it has received encouragement and support for its aims from educationalists and industrialists not only in Gloucestershire but also in other parts of the country. Briefly, the purpose of the Council is to act as a link between schools and industry by "fostering and promoting education for industry with particular emphasis on engineering as part of the school curriculum." Composed of experienced industrialists, the Council endeavours to bring to the notice of boys and girls of school age the rewarding and satisfying careers to be found in many branches of industry vital to the economic future of the country.

Financial backing for the scheme has so far been provided mainly by nine member firms, but with the gradual increase in the scope of the Council's activities, it is now hoped that many of the remaining 60 firms—both large and small—which operate within the county boundaries will give additional support. The present chairman and members envisage the transformation of the organization into a larger association comprising all or most of the industrial undertakings in Gloucestershire, which would from time to time elect a council responsible for shaping policy. Although the Council has accomplished much since its inception, there remains a number of important tasks to be performed, for example, the establishment of a local group apprentice training scheme which would enable small firms with limited financial resources to provide adequate training facilities. On many occasions it has been possible to arrange for member firms to release qualified men from their normal duties to make instructional visits to schools and colleges.

A recent innovation has been the establishment of a technical library at the G.I.E.C. offices, 8 Lansdown Place, Cheltenham, where a selection of modern books likely to be of assistance to potential engineers is available for the use of pupils attending schools in Gloucestershire. The books provided by this library are not normally purchased by or obtainable in schools. A newsletter is also circulated to schools in the county as a means of disseminating information concerning the Council's activities. The stimulation of pride in craftsmanship is another aim, in pursuit of which a competition was recently organized for apprentices of different grades attending schools and engineering establishments.

Evidence of the interest being shown in its work was afforded by the attendance, at a recent conference held by the Council in Cheltenham, of more than 200 delegates from schools, colleges, research establishments and industry, who listened to addresses by prominent people connected with education and industry. The proceedings lasted for two days and included discussion periods. In addition, a number of short films based on technical subjects was shown.

During the period of the conference, an exhibition, organized by the Council, was staged, for the purpose of portraying the wide range of industries at present established in Gloucestershire. Held in tented structures adjacent to the conference hall, the exhibition attracted much interest, particularly among scholars and younger members of the community, who were able to seek advice from representatives attending the stands as to the various ways of starting a worth-while career in engineering. Examples of work produced by apprentices at different stages of their training were a prominent feature of the exhibition, which was also noteworthy for the high proportion of apprentices included among the stand attendants. An interesting stand provided by the technical colleges of the county was designed to show the extent to which technical education is available in the area.

The chairman of the G.I.E.C. is Lt.-Gen. Sir John Evetts, C.B., C.B.E., M.C. (Rotol, Ltd., and British Messier, Ltd.), the remaining members being Sir George Dowty, F.R.Ae.S., M.I.Mech.E. (Dowty Group), Sir Roy Fedden, M.B.E., D.Sc., M.I.Mech.E. (Consulting Engineer), Mr. C. A. W. Bird (Thos. Bugbird & Son, Ltd.), Mr. H. Burroughes, F.R.Ae.S. (Hawker Siddeley Group), Mr. A. O. R. Johnson (T. H. & J. Daniels, Ltd.), Mr. F. J. Fielding, M.I.Mech.E. (Heenan Group), Mr. K. J. Hume, B.Sc., M.I.Mech.E. (Dowty Group), Mr. G. C. Roberts, M.Sc., A.F.R.Ae.S. (S. Smith & Sons), Mr. K. W. Watson, A.R.Ae.S. (Armstrong Siddeley), Mr. S. O. Peebles, A.R.Ae.S. (Rotol, Ltd., and British Messier, Ltd.), Mr. A. Palmer (Telehoist, Ltd.), and Mr. A. D. P. Tallents (Impregnated Diamond Products). The Secretary to the Council is Mr. G. T. Page, M.A., 8 Lansdown Place, Cheltenham.

News of the Industry

Halifax

GEORGE SWIFT & SONS, LTD., Claremount, have now completed and occupied their office extensions and good progress is being made with the new 250- by 50-ft. heavy lathe erection shop which, it is hoped, will be in operation by the end of the year. Two Vaughan 25-ton overhead electric travelling cranes are to be installed. Orders are in hand for standard lathes ranging from 8½- to 27-in. centres, also for a number of special-purpose types. The latter include 21-in. centre lathes for machining electrodes, which are equipped with special duplex milling heads for taper boring and thread milling; 24- and 36-in. swing, hydraulically-operated, face copying lathes; 12½-in. centre lathes for turning and boring operations on valves and valve taper discs and inserts; and 16- and 19-in. centre lathes with faceplate drives for machining titanium. Export markets for lathes include South Africa and India.

OLDFIELD & SCHOFIELD CO., LTD., Boothtown, are occupied with the production of standard lathes ranging from 12½- to 24-in. centres, and we may note that orders are in hand for 4-ft. carriage and wagon wheel lathes for Australia, and for axle journal turning lathes, equipped with grinding heads, for British Railways. We hope shortly to describe one of the latter machines. Other work in progress includes straightening presses up to 60 tons capacity.

JOHN STIRK & SONS, LTD., Boothtown, have a good order book for double-standard and openside-type planing machines, the former ranging in size from 3 to 10 ft. wide, and the largest having a 20-ft. stroke, and a planing capacity up to 8 ft. high. Openside-types include a number of machines for planing 6 and 7 ft. wide. Some of these planers are destined for British Railways workshops and for Australia and India. A 10-ton per hour cupola has been installed in the foundry to supplement the output of the previously available 5- and 6-ton sizes.

COVENTRY MACHINE TOOL WORKS, LTD., Boothtown, are steadily engaged in the production of Covmac horizontal hot forging machines, the sizes in hand ranging up to 3-in. bar capacity. Another of the firm's fully-automatic forging machines is in progress, and is destined for Australia.

S. APPLEYARD & CO., Boothtown, who are experiencing a somewhat reduced demand for their normal ranges of single- and double-ended punching, shearing, and angle cropping machines, and bar croppers, are carrying out reconditioning of plate- and bar-working machinery of various types, and supplying spares, such as punches, dies and shear blades.

DENHAM'S ENGINEERING CO., LTD., Holmfield, whose standard lathes range from 17 to 41½ in. swing, are at present also building lathes of 45- and 47-in. swing, and some of the lathes in progress are being provided with copying equipment. Demonstrations of the 20¾-in. centre lathe for profiling Doxford marine diesel engine piston heads, as supplied to Swan, Hunter & Wigham Richardson, Ltd., Newcastle-upon-Tyne, and described in MACHINERY, 93/734—24/9/58, have been held, for North of England and Scottish engineers, at the Tyneside works. Machines recently ordered have included two SR8v 17-in. swing lathes for turning copper billets, and two similar lathes, for surfacing and boring operations, are destined for Scotland and South Africa. We may also note orders for four special lathes for turning graphite electrodes from 3 to 30 in. diameter, and the jointing nipples. There are two sizes of electrode lathes and two sizes of nipple lathes. The nipples are of double-tapered form and pneumatic operation is provided for the feeds, tailstocks, and chucks on these lathes. On the smaller nipple lathe the spindle speeds range from 400 to 2,000 r.p.m. We hope to describe these machines more fully in due course. A 16¾-in. centre lathe, which has been despatched to a Rhodesian copper mine, has a 14-in. bore spindle, and twin gaps in the bed, to enable railway wagon wheel sets to be re-turned.

WILLSON LATHES, LTD., Ovenden, in view of the quieter demand for standard 6½-, 7½-, and 8½-in. centre lathes, have now extended their range to include sizes up to 18-in. centres, with beds up to 32 ft. long. The reconditioning of all types of machine tools, up to a weight of 10 tons, is also being undertaken, and our attention was drawn to a recently-overhauled planing machine of 16- by 6- by 5-ft. capacity.

BINNS & BERRY BROS. (HALIFAX), LTD., Ovenden, in addition to their standard 6½- to 12½-in. centre lathes, some of which are destined for the U.S.A., are building a number of thread whirling machines, scalping lathes for extruded alloy

steel bars, and a 60-in. swing surfacing and boring lathe.

HALIFAX RACK & SCREWCUTTING CO., LTD., Ovenden, report a good demand for the cutting of racks and traverse screws, including thread-whirled screws. A lead screw pitch correction service is now provided at these works.

STANLEY MACHINE TOOL CO., LTD., New Bank, have orders in hand for standard lathes of 7½-, 8½-, and 10½-in. centres, also for sliding-bed lathes of 10½-, 12½- and 14½-in. centres. One of the latter has a 24-ft. long bed. Export markets represented in the order book include Australia, New Zealand, South Africa, Canada, India, and the Middle East.

JOHN MITCHELL & CO. (HALIFAX), LTD., Godley Ironworks, are steadily employed on the production of 8½-in. centre all-geared head lathes with 6-ft. and 8-ft. beds, also with longer beds, to special requirements. H. B.

Grantham

RUSTON & HORNSBY, LTD., are actively engaged in the production of horizontal oil engines, ranging from 5 to 35 h.p., vertical oil engines from 4 to 12½ h.p., pumps up to 24-in. bore, and gearboxes.

AVELING-BARFORD, LTD., have a good programme of diesel road rollers, petrol rollers, dumpers, calf-dozers, motor graders and trench cutting machines in progress, a proportion of which is destined for export. In association with GOODWIN BARSBY & CO., BARFORD (AGRICULTURAL), LTD., the company displayed some 19 machines, comprising road-making, earthmoving, building and agricultural equipment, at the Public Works Exhibition at Olympia. These exhibits included various sizes of road rollers, dumpers, graders, a mobile asphalt plant, an Acme crusher, and other products, which incorporate various improvements in design and new features. The latest addition to plant at these works is a Kearns Optimetric toolroom boring machine.

R. H. NEAL & CO., LTD. (head office—Longfield Avenue, London, W.5), have home and overseas orders in hand for a wide range of mobile cranes. Recent developments include the all-hydraulic Hymax crane which carries a maximum load of 10,000 lb., with the jib horizontal, under 8 ft. headroom. Telescoping of the jib, slewing, derricking and steering are all hydraulically operated, and the crane has exceptional out-reach and rapid travelling speed. Attention may also be drawn to the recently-developed types NMS and NS70 fully mobile cranes which have full circle slewing and direct mechanical-diesel drive. H. B.

Lincoln

ROBEY & CO., LTD., have a variety of work in progress, including electric winders for the National Coal Board, also Lloyds Class 1 fusion-welded pressure vessels and fabricated steel components for various industries, and experimental steam engines for educational establishments. There is an increasing demand for Meehanite castings for applications demanding heat, wear or corrosion resistance, and some of these castings are being supplied for atomic power stations.

CLARKE'S CRANK & FORGE CO., LTD., are well placed for orders for forged and machined diesel oil engine crankshafts, in a wide range of sizes, also for air compressor, locomotive and pump crankshafts. We may note that work is in progress for the National Coal Board.

ICTA, LTD., are doing a good business in their various types of cemented-carbide-tipped tools and high-speed steel solid and butt-welded lathe and planer tools. Both special and standard form tools, for the motor car, aircraft, and other industries, are in good request. The latest addition to the plant is a British Furnaces fully-automatic, atmosphere-and-temperature-controlled, gas-fired high-speed steel heat-treatment furnace. H. B.

Industrial Design

A section of the November issue of *Design*, the journal of The Council of Industrial Design, The Design Centre, 28 Haymarket, London, S.W.1, and The Council of Industrial Design Scottish Committee, Scottish Design Centre, 46 West George Street, Glasgow, C.2, is devoted to the first of a series of articles on the importance of combining functional and æsthetic design in machine tools. As an example of how this combination can be achieved successfully a "case-history" is given of the re-design of an open-fronted, inclinable press. The machine in question is a 35-ton press built by E. W. Bliss (England), Ltd., and when the company decided to re-design, the solution of the problems of improving the external appearance was entrusted to a consultant industrial designer. This designer, who was concerned primarily with re-styling the machine, worked in collaboration with the firm's senior design engineers, who were responsible for its functional aspects.

The procedure which was adopted involved three distinct phases. Firstly, meetings were held at which the firm's designers discussed the changes which were to be made in the mechanical arrangement of the machine, with the industrial designer present with a "watching brief." For the most

part, the changes decided upon at these meetings were made as a result of troubles encountered during production and maintenance of the machine in the past. When this stage had been completed, the industrial designer severed contact with the company's engineers, and in due course prepared a number of sketches, and a wooden model, of the newly-designed press as he conceived it.

During the third, and final, stage, a series of meetings was held at which a compromise was reached between the requirements of both parties. In some instances, the consultant's design had to be modified for practical reasons peculiar to the type of machine concerned, but on the whole, it is stated, the outcome of the collaboration was extremely successful.

It is suggested in the article that the need to balance what is æsthetically desirable against what is functionally necessary, and what is commercially needed against what is economically possible, may become increasingly important with the advent of the European Free Trade Area.

Lapping Machine Demonstration

Payne Products International, Ltd., Lawrence Estate, Green Lane, Hounslow, Middlesex, are staging demonstrations, until November 21, of British-built Lapmaster flat lapping machines for which they are the distributors.

The company also undertakes the precision lapping of components on a contract basis, and Lapmaster machines in the 12-, 24-, and 36-in. sizes are available at the Hounslow works for this purpose. A 48-in. machine, which, as was mentioned in MACHINERY, 92/1284—30/5/58, has recently been added to the British-built Lapmaster range, will shortly be installed.

Lapmaster machines permit workpieces to be held to an accuracy of 1 light band (0·0000126 in.) for flatness and to a surface finish as smooth as 2 micro-inches. Among the wide range of precision lapped components that is being shown in connection with the demonstration may be mentioned small ceramic pieces with a thickness of only 0·0025 in. Items in steel, cast iron, aluminium and brass, including camera parts, components for motor-car engines, electric razors, and vacuum pumps, and extrusion dies for nylon threads, are also available for inspection, and afford an indication of the diversity of work that can be handled on Lapmaster machines.

It may be mentioned that a 36-in. machine with an 80-in. convex radius formed on the working surface of the lap has recently been supplied by the company for producing a concave surface on the component. In addition, development work is in progress in connection with the lapping of convex surfaces. Reference may also be made to a set-up, which is being shown, for lapping a valve guideway in the bore of a component for a railway air brake. The guideway takes the form of a slot which extends for the full length of the bore, and the rectangular-section lap is reciprocated by means of a connecting rod, attached to an eccentric mounted on the circular lap of the Lapmaster machine. The workpiece is held in a fixture secured to a fixed plate on the bed. Contact pressure between the rectangular lap and the slideway is applied by a spring-loaded attachment which passes through the workpiece bore. While the operation on the slideway is in progress, the mating valve slide is lapped, and other rectangular laps are conditioned, in preparation for future use, by means of the circular lap of the machine.

A department has been established at the company's works for the production of optical flats from 1 to 12 in. diameter in plate glass, Pyrex and quartz. The re-conditioning of optical flats, and the precision polishing of lapped workpieces, is also undertaken in this department.

The company has recently been appointed sole agent in this country for the Swiss-made Diavite Microtester surface finish testing equipment, which is available for demonstration.

New Electrical Engineering Courses

In view of the increasing demand for highly-trained electrical engineers, the governors of Faraday House Engineering College, 66 Southampton Row, London, W.C.1, have introduced so-called "sandwich" courses for men and women in industry, as a part of a revised educational policy. A new award, which is known as Associate Faraday House, has been established, and is to be presented on satisfactory completion of studies in one of the following subjects: power engineering; light engineering; telecommunications; and electronics.

Under the new policy, a student is selected by an industrial concern from its employees, and spends six months in the works and six months in the College over a total period which may range from four to five years, depending on the level of education at entry. On conclusion of a period of basic training, the employer, the college principal, and the student decide among themselves whether the student is better fitted to take the Associate course for the remainder of the training period, or to study for the Diploma Faraday House award which leads to professional status. For successful completion of the academic part of the Diploma syllabus only, an intermediate award entitled

Graduate Faraday House has now been introduced.

It is pointed out that the Associate award is not intended to denote specialists but rather electrical engineers who have received a general education with particular concentration on the subjects in which they seek careers.

Association of Engineering Distributors

At the 15th annual general meeting of the Association of Engineering Distributors, Ltd., Hastings House, Norfolk Street, London, W.C.2, Mr. Ralph Hall, managing director of John Hall Tools (Group), Ltd., was elected president, and Mr. A. N. Creed, of Power Tools (Specialities), Ltd., and Mr. K. C. Allen, of A. H. Allen & Co. (Engineers), Ltd., vice presidents. Mr. R. A. Harding, Macrome, Ltd., was elected to membership of the Council. After the meeting, Mr. R. F. Collischon, national vice-chairman and fellow of the Sales Managers' Association, Inc., and managing director of Colbeam Palmer, Ltd., spoke on "The Art of Selling."

The meeting was followed by the annual luncheon at which Mr. J. Hugh Neill, Master Cutler of Sheffield, proposed the toast of "The Association of Engineering Distributors," and Mr. Ralph Hall responded. The toast of "The Guests" was then proposed by Mr. K. C. Allen, and Mr. R. S. Bruce, vice-president of the Sheffield Chamber of Commerce, replied.

Mikron Golden Jubilee

The Swiss firm of Mikron S.A., Bienne, who are well known for their range of high-precision gear and thread cutting machines, are this year celebrating their golden jubilee. Founded in 1908 in a small workshop in Bienne, the company initially had a staff of four and 14 workmen. In the beginning, attention was concentrated on designing and building a comprehensive range of small precision lathes and milling machines for the Swiss watch industry, but the founders were soon convinced of the advantages which were to be gained from the hobbing process for the production of small gears. Accordingly, in 1912, they introduced their first gear hobbing machine, known as the type No. 79, and, at the same time, started the manufacture of hobs. The latter, it may be noted, were produced, from the early days, with pitches as fine as 150 D.P. Over the years the range of machines was steadily widened, and in 1925 the type 104 thread milling machine was introduced. One of the latest developments, which was shown at the recent Milan machine tool exhibition, is a hopper feed for the No. 119 pinion hobbing machine which provides for fully automatic operation.

The company is still situated in Bienne, where it has a modern well-equipped factory which, within the last two years, has been considerably enlarged. Today, the policy remains unchanged in that machines are built only for small high-precision work, as was the intention when the firm was founded 50 years ago.

Mikron S.A. are represented in this country by Henry Turner (Machine Tools), Ltd., 58 Upper Tooting Road, London, S.W.17.

British Machinery Merchants

At a conference held recently in London it was decided to form the Association of British Machinery Merchants. Mr. Harold Vernon, of Thos. W. Ward, Ltd., Sheffield, who took the chair at the meeting at the invitation of the convener, Mr. C. W. Allen, was elected president. Other officers are as follows: deputy president, Mr. H. E. Reed (Reed Brothers [Engineering], Ltd.); treasurer, Mr. H. D. Leete (Hodson & Co. [Machinery], Ltd.); and secretary, Mr. C. W. Allen. Proposed terms of reference which had been drawn up were unanimously adopted by the meeting.

The new Association is intended to meet the needs of those merchanting firms not at present catered for by existing specialist organizations, and full particulars can be obtained from Mr. C. W. Allen, 100 Park Street, Grosvenor Square, London, W.1.

The Packaging Centre

The Packaging Centre, 50 Poland Street, London, W.1, which was opened earlier this year by Sir David Eccles, President of the Board of Trade, provides a permanent display of materials and equipment for the protective packaging of a wide variety of consumer goods and industrial machinery, and at present more than a hundred firms are represented. A comprehensive information service is available relating to exhibits, and advice is given on packaging problems.

Industrial Notes

WEBLEY & SCOTT, LTD., have now occupied new works at Park Lane, Handsworth, Birmingham, 21 (telephone number, West Bromwich 2821).

THE EXPANDED METAL CO., LTD., Burwood House, Caxton Street, Westminster, London, S.W.1, have acquired the whole of the ordinary and preference share capital of The Glasgow Expanded Metal Co., Ltd.

PHILIP DE HAVILLAND MACHINE CO., LTD. Following a reorganisation, the administration of this company is now being carried on from the following address: Industrial Estate, Cheney Manor, Swindon, Wilts. (telephone number, Swindon 6336-7).

ALFRED BULLOWS & SONS, LTD., Long Street, Walsall, Staffs., have introduced a lightweight air hose for use with their "baby" L 900 spray gun. This rubber hose, covered with rayon braid, has a $\frac{5}{16}$-in. bore. It is light and flexible, and ensures ease of handling.

ANGLO-SWISS SCREW CO., LTD., Trout Road, West Drayton, Middlesex.—On the occasion of a recent dinner and dance, gold watches were presented to four employees, each of whom had just completed 25 years' service. The number of these long service employees is now 35.

CLARE COLLETS, LTD., Broadheath, Altrincham, Cheshire, have appointed Stewart & Houston, 5 York Street, Glasgow, C.2, as sole agents for Clare milling equipment in Scotland. Stocks of all standard items will be carried and a technical service for milling problems will be provided.

FRED FERRARIS (CLERKENWELL), LTD., 18a Northampton Square, Ashby Street, Clerkenwell, London, E.C.1, have established a new division for miniaturization of instruments. This division will give advice, carry out research, develop prototypes, or undertake production in this field.

AN AUCTION SALE OF MACHINE TOOLS and miscellaneous stores from M.O.S. Storage Depot, Byley, Middlewich, Cheshire, will be held on December 2 at New Islington Public Hall, Ancoats, Manchester. The auctioneers will be J. H. Norris & Son (Dept. N), 9 Albert Square, Manchester, 2.

VERNON INSTRUMENT CO., LTD., inform us that they have recently taken possession of new works premises and that their address, also that of their associate companies, George Vernon Sales, Ltd., and George Vernon, Ltd., is Wilbury Way, Hitchin, Herts. (telephone number, Hitchin 2322/4).

KLOCKNER MOELLER (ENGLAND), LTD., 7 Charterhouse Buildings, Goswell Road, London, E.C.1. The authorized capital of this company has been increased from £3,000 to £16,000, as from September 23. Of the extra £13,000, £10,500 has been issued and the remainder will be issued shortly.

THE BRITISH ASSOCIATION OF MACHINE TOOL MERCHANTS, Effingham House, Arundel Street, Strand, London, W.C.2. —The 18th annual general meeting will be held at The May Fair Hotel, London, on November 25, and will be followed by a luncheon at which Mr. W. J. Taylor, C.B.E., D.L., J.P., M.P., Parliamentary Secretary, Ministry of Supply, will deliver an address.

THE BRITISH PRODUCTIVITY COUNCIL, 21 Tothill Street, London, S.W.1, has been appointed to represent the United Kingdom on the management of the European Organization for Quality Control, a body which has been set up by the European Productivity Agency to stimulate an international appreciation of quality standards and quality control procedure.

BALDWIN INSTRUMENT CO., LTD., Brooklands Works, Dartford, Kent, have established a team of application and design experts to give advice on the use of their wide range of equipment. With the assistance of the Baldwin Electronic Division, the team will make recommendations for complete installations for pneumatic, hydraulic, or electrical control.

ROLAND GOODALL, LTD., 19 Station Road, Burton-on-Trent, have been appointed sole agents in the United Kingdom for the Nibro-Max range of steplessly variable speed (1,000 to 40,000 r.p.m.) flexible shaft machines and accessories, for such operations as sanding, grinding, nibbling, and shearing, made by Niederberger & Co., Lucerne, Switzerland.

MARSTON EXCELSIOR, LTD., Wolverhampton, a subsidiary of Imperial Chemical Industries, Ltd., have introduced flexible containers known as Portolite tanks for the transport and storage of a wide range of bulk liquids. Made from coated, strong woven fabrics, the tanks are light, and for return journeys they can be rolled up and occupy little space.

H. WILLIAMS & SON, LTD., Lark Works, Sandridge Road, St. Albans, have appointed W. O. Bullock & Sons, Ltd., 126 Rodbourne Road, Swindon, Wilts., as selling agents for all items which they manufacture or market, including Swiss Compac and Parvus dial gauges, and Swedish Oberg burrs, in the counties of Wiltshire, Hampshire, Dorset, Devon, Cornwall, Somerset, Gloucester, Monmouth, Glamorgan, Carmarthen, and Pembroke.

THE SHEFFIELD TWIST DRILL & STEEL CO., LTD., Summerfield Street, Sheffield, 11, have drawn our attention to the technical advisory service which they offer throughout the country. In this connection recommendations are made concerning the correct use of twist drills, reamers, end mills, milling cutters, and machine vices, and investigations are carried out in instances where it is believed that the performances of tools could be improved, or alternative types recommended for particular operations. To provide such a service in London and the south of England, Mr. Roger Knowles, who has spent some years in the Sheffield works, has been appointed technical representative for the area, and he will also be concerned with the introduction of the latest Dormer products.

Personal

MR. DAVID E. BURTON, B.Sc.(Eng.), is now in charge of the London technical sales department, at Ibex House, Minories, E.C.3, of Rocol, Ltd., Swillington, near Leeds.

MR. A. C. BURN, of Sales Audits, Ltd., has been elected to the board of North West Machine Design Co., Ltd., 177 Kenton Road, Kenton, Harrow, Middlesex.

MR. G. RONALD GREEN has been appointed general sales manager of Tangyes, Ltd., Cornwall Works, Smethwick, Birmingham.

MR. G. P. DARNLEY and MR. R. C. WEBSTER have been appointed joint managing directors of Bratby & Hinchliffe, Ltd., Gorton Lane, Manchester, 18.

MR. J. T. TROMAN has been appointed a director of the machine tool division of B. O. Morris, Ltd., at Portsmouth, and MR. O. G. EVES has been appointed works director for the company at Coventry.

SIR DONALD BAILEY, O.B.E., J.P., Director of the Ministry of Supply's Military Engineering Experimental Establishment at Christchurch, Hants, and inventor of the Bailey bridge, has been co-opted to the Council of the British Welding Research Association, 29 Park Crescent, London, W.1.

MR. ARTHUR GRIFFITHS, O.B.E., M.I.Prod.E., has been appointed group managing director of Sterling Industries, Ltd., Chard, Somerset. Until 1956 he was a director and general manager of the Daimler Co., Ltd., Coventry, and had previously held the position of general manager for F. Perkins, Ltd., Peterborough.

MR. E. J. PLAYER and MR. W. W. JEACOCK, M.I.Prod.E., have been appointed divisional directors (a newly established post) of Coventry Gauge & Tool Co., Ltd., Coventry. MR. H. ROCKWELL, B.Sc. (Eng.), A.M.I.Mech.E., MR. P. F. ROCKWELL, B.Sc. (Econ.), A.C.A., MR. H. A. CHAMBERS, M.I.Prod.E., and MR. J. M. BRICE, M.I.Prod.E., hold similar positions (divisional director) with Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, N.W.2.

MR. E. D. DAWSON has been appointed a director of the Selson Machine Tool Co., Ltd., Minerva Road, London, N.W.10, a member company of the George Cohen 600 Group. He joined the firm after leaving school in 1936. During the war he served in R.N. landing craft and minesweepers and after he was demobilized he returned to Selson. From 1947 to 1950 Mr. Dawson was outside representative for London and the Eastern Home Counties. He was appointed sales manager in 1954, and as a member of the board will continue to be responsible for sales.

Mr. E. D. Dawson

Coming Events

MANCHESTER ASSOCIATION OF ENGINEERS. November 28, at 6.45 p.m., at the College of Science and Technology, Sackville Street, Manchester; lecture on "Electromechanical Themes in Machine Tool Design," by the Earl of Halsbury.

INSTITUTION OF ELECTRICAL ENGINEERS. *Western Centre.* November 27, at 6.45 p.m., at the Colston Hall, Bristol; and *West Wales (Swansea) Sub-centre.* November 25, at 6 p.m., at the Brangwyn Hall, Swansea. Faraday lecture on "Automation," by H. A. Thomas.

INSTITUTION OF MECHANICAL ENGINEERS. November 26, at 5.30 p.m., at the Institute of Marine Engineers' Memorial Building, 76 Mark Lane, London, E.C.3; Sir John Parsons Memorial Lecture on "Recent Advances in Nuclear Engineering," by Sir John D. Cockcroft, O.M., K.C.B., C.B.E. *North Western Branch, Industrial Administration and Engineering Production Group.* November 27, at 6.45 p.m., at the Engineers' Club, Albert Square, Manchester, 2; lecture on "Application of Optics in Engineering Inspection," by O. C. Taylerson.

INCORPORATED PLANT ENGINEERS. *Merseyside and North Wales Branch.* November 27, at 7.15 p.m., at the Exchange Hotel, Liverpool; paper on "Some Aspects of Automatic Control," by R. E. Harvison, B.Sc.

INSTITUTION OF PRODUCTION ENGINEERS. *Shrewsbury Section.* November 25, at 7.30 p.m., at the Walker Technical College, Oakegates, Shrewsbury; lecture on "Ceramic Cutting Tools," by G. R. Conner. *Worcester Section.* November 26, at 7.30 p.m., at the Victoria College, Worcester; lecture on "Spark Machining," by E. A. Sweetman. *Loughborough College Student Section.* November 25, at 7.30 p.m., in Room A.1, Loughborough College, Schofield Building, Ashby Road, Loughborough; lecture on "A Modern Foundry for the Manufacture of Small Steel Castings by New Moulding Techniques," by J. H. Osborn. *Lincoln Section.* November 27, at 7.30 p.m., at the Ruston Club, Lincoln; lecture on "Some Factors Affecting Cutting Tool Performance," by R. J. Cowie. *Manchester Section.* November 24, at 7.15 p.m., at the Manchester College of Science and Technology, Sackville Street, Manchester; lecture on "Diploma in Technology," by Dr. Whitworth, Ph.D., M.Sc. *Stoke-on-Trent Section.* November 24, at 7.30 p.m., at the Grand Hotel, Hanley, Stoke-on-Trent; lecture on "The Use of Rubber in Engineering," by Dr. A. N. Grant, Ph.D., B.Sc. *Rochester Graduate Section.* November 27, at 7.30 p.m., at the Sun Hotel, Chatham High Street, Rochester, Kent; lecture on "Lens Manufacture," by E. Atkinson. *Cardiff Section.* November 28, at 7 p.m., at the South Wales Institute of Engineers, Park Place, Cardiff; lecture on "Tooling with Epoxy Resins," by E. M. White.

Correction

The Highwood Engineering Co., Ltd., 71-75 Allcock Street, Birmingham, 9, inform us that they designed and supplied the guard shown fitted to an E.M.B. No. 12 die casting machine in Fig. 5 of the article devoted to "Safety Arrangements for Pressure Die Casting Machines," in MACHINERY, 93/1003—29/10/58. In the caption to this illustration, and the accompanying text, the guard was inadvertently attributed to another maker.

Training for Electrical Engineers

The Council of the Institution of Electrical Engineers, Savoy Place, London, W.C.2, have for some time been concerned that the plans to expand the industrial training of professional engineers have not kept pace with the Government's programme of expansion for the universities and technical colleges for the purpose of increasing the number of technologists.

If there is to be a substantial increase in the number of engineers who receive adequate industrial training in electrical engineering, means must be found to provide such training facilities in the smaller and particularly in the more specialized firms in the electrical engineering industry, and in those concerned in the utilization of electrical power. Many of these concerns cannot provide the breadth of training which is necessary within their own organizations, and, in the hope that it may be possible to arrange for co-operative effort in the provision of such training, the Council have decided to stage a conference on November 21, at which this matter may be fully discussed.

Machine Tool Share Market

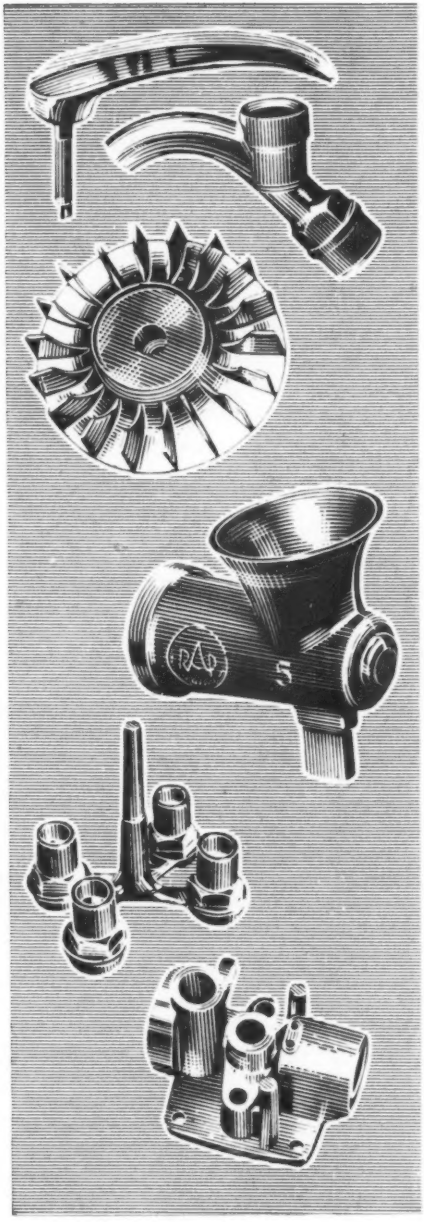
Stock markets were very active during the period under review, and although the general tendency was irregular, the underlying tone remained firm. Interest was centred mainly in the commercial and industrial sections where good class ordinary shares were in demand at improving levels. Some irregularity in price movements was shown, but changes were mostly favourable, on balance, and many bright features were in evidence.

The gilt-edged section, however, was depressed, and for the most part quotations for British Funds and kindred stocks moved downwards owing to persistent small selling and lack of support. Towards the finish, however, prices were inclined to rally.

Among machine tool issues, Armstrong Stevens advanced 10½d. to 9s. 1½d.; Asquith Machine Tool, 3d. to 24s. 6d.; Clarkson Engineers, 3d. to 15s. 3d.; Kitchen & Wade, 3d. to 8s. 3d.; F. Pratt, 3d. to 22s. 9d.; British Oxygen, 1s. 6d. to 45s. 6d.; Brooke Tool, 1½d. to 4s.; Chas. Churchill, 4½d. to 6s. 9d.; John Harper, 4½d. to 16s. 6d.; John Holroyd "A," 6d. to 13s. 6d.; John Holroyd "B," 6d. to 13s. 3d.; Ambrose Shardlow, 2s. to 45s. 6d.; and John Shaw & Sons (Wolverhampton), 9d. to 14s. 6d. On the other hand, Broom & Wade lost 3d. at 11s. 6d.; Craven Bros. (Manchester), 1½d. at 8s. 4½d.; Modern Engineering, 6d. at 9s. 6d.; and Thos. W. Ward, 7s. 3d. at 79s. 9d.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrongs, Stevens & Son, Ltd.	Ord.	5/-	9/1½
Allen (Edgar) & Co., Ltd.	Ord.	£1	38/-
" "	5% Prf.	£1	15/3*
Arnott & Harrison, Ltd.	Ord.	4/-	15/6
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	24/6
" " "	6% Cum. Prf.	£1	18/6
Birmingham Small Arms Co., Ltd.	Ord.	£1	35/-xd
" " "	5% Cum. "A" Prf.	£1	15/-
" " "	6% Cum. "B" Prf.	£1	18/-
" " "	4% 1st Mort. Deb.	Stk.	88½
British Oxygen Co., Ltd.	Ord.	£1	45/6
" " "	6½% Cum. Prf.	£1	22/-
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	4/-
Broom & Wade, Ltd.	Ord.	5/-	11/6
" "	6% Cum. Prf.	£1	17/9
Brown (David) Corporation Ltd.	5½% Cum. Prf.	£1	15/4xd
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/9
Butler Machine Tools Co., Ltd.	Ord.	5/-	8/-
" " "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	11/3
Churchill (Charles) & Co., Ltd.	Ord	2/-	6/9
" " "	6% Cum. Prf.	£1	26/4½
Churchill Machine Tool Co., Ltd.	Ord.	5/-	18/3
" " "	6% Cum. Prf.	£1	18/3
Clarkson (Engrs.), Ltd.	Ord.	5/-	15/3
Cohen (George), Son & Co., Ltd.	Ord.	5/-	10/6
" " "	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	17/-
" " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	8/6
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/4½
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/-
" "	4½% Red. Cum. Prf.	£1	13/9
Expert Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/6
Greenwood & Batley, Ltd.	Ord.	£1	52/6
Harper (John) & Co., Ltd.	Ord.	5/-	16/6
" "	4½% Red. Cum. Prf.	£1	12/10½
Herbert (Alfred), Ltd.	Ord.	£1	37/6
Holroyd (John) & Co. Ltd.	"A" Ord.	5/-	13/6
	"B" Ord.	5/-	13/3
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	22/-
" " "	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	46/6
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/-
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/10½
Kitchen & Wade, Ltd.	Ord.	4/-	8/3xd
Martin Bros. (Machinery), Ltd.	Ord.	2/-	1/6
Massey, B. & S., Ltd.	Ord.	5/-	9/6
Modern Engineering Machine Tools Ltd.	Ord.	5/-	9/6
Newall Engineering Co., Ltd.	Ord.	2/-	4/9
Newman Industries, Ltd.	Ord.	2/-	2/9
" "	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	3/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	20/3
" " "	5½% Cum. Prf.	£1	26/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	22/9
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/6
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	45/6
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	14/6
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	13/6
" " " "	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	7/6
	"B" non-voting Ord.	10/-	22/6
Tap & Die Corporation, Ltd.	Ord.	5/-	8/-
" " "	4½% Deb. 1961-1977	Stk.	82/-
Wadkin, Ltd.	Ord.	10/-	18/9
Ward (Thos. W.), Ltd.	Ord.	£1	79/9
" "	5% Cum. 1st Prf.	£1	16/-
"	5% Cum. 2nd Prf.	£1	24/-
Willson Lathes, Ltd.	Ord.	1/-	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.



For purity in diecasting

POLAK

DIECASTING MACHINE

POLAK pressure diecasting machines are being extensively used at present for a variety of casting work throughout the world. On the left are typical castings produced with the machine.

POLAK diecasting machines cast aluminium, zinc, copper, magnesium and alloys of other non-ferrous metals.

Aluminium alloys can be cast up to a weight of 1·32 lbs. (1·76 lbs. in special cases), zinc alloys up to 3·35 lbs. and copper alloys up to 2·76 lbs.

Control is fully hydraulic and the semi-automatic nature of the machine enables it to be operated by semi-skilled labour.

BRIEF SPECIFICATION

Average output per hour, according to casting, 80 shots to 180 shots.

Pressure of operating liquid atm., 120/1,700 p.s.i.

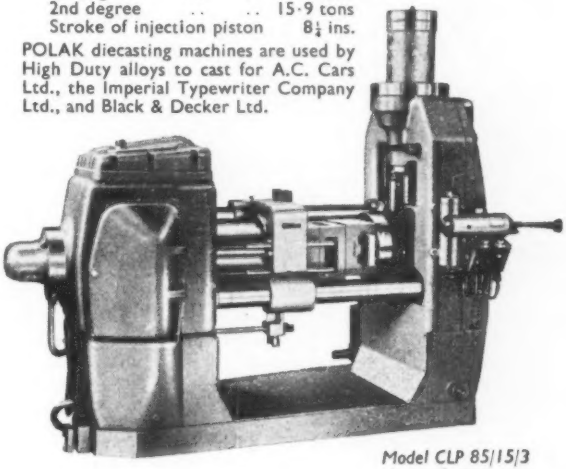
Closing:—

Maximum dieclosing force	85 tons
Stroke of closing piston	12⅛ ins.
Maximum opening of machine ..	29½ ins.
Minimum opening of machine ..	17¼ ins.

Pressure applied to metal:—

1st degree	11·2 tons
2nd degree	15·9 tons
Stroke of injection piston	8¼ ins.

POLAK diecasting machines are used by High Duty alloys to cast for A.C. Cars Ltd., the Imperial Typewriter Company Ltd., and Black & Decker Ltd.



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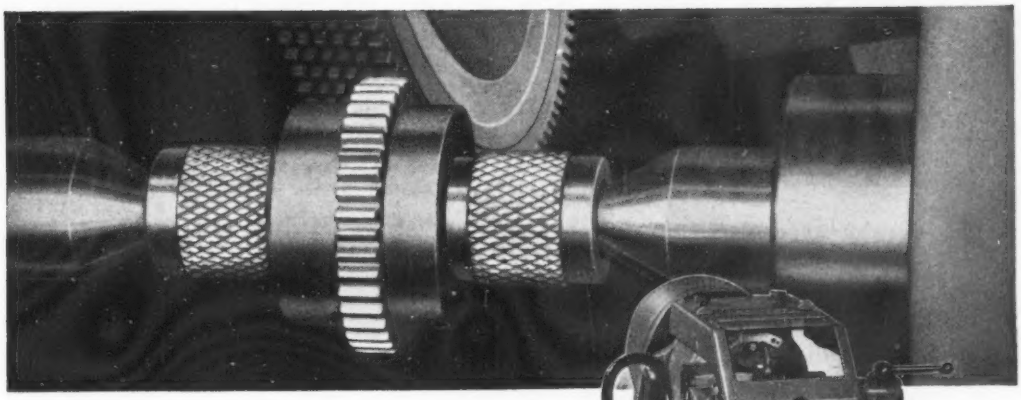

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Electrical Aids in Industry *Data Sheet* **No. 3**

Induction Heating - 2

The broad principles involved in the use of induction heating for melting and processing metals have already been dealt with in this series (Data Sheet No. 2). In order to make a critical examination of its possibilities, however, the potential user should be aware of certain technical factors which must influence his decisions.

Induction heating, of course, demands the use of alternating current which is available from the public supply at a frequency of 50 cycles per second. Higher frequencies, however, are desirable for certain applications and can be obtained by means of the appropriate conversion equipment. Frequencies can therefore be considered in three categories:

Mains Frequency
(direct from mains)—50 c.p.s.
Medium Frequency
(machine generator)—50–10,000 c.p.s.
High Frequency
(electronic generator)—up to about 2,000,000 c.p.s.

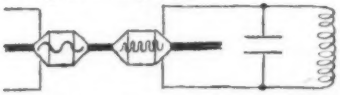
Mains Frequency

This needs no conversion equipment; it is particularly suitable for melting large pieces of scrap, and owing to the vigorous stirring forces produced, is excellent for alloy making. It has the merit of low initial cost compared with the high frequency method of melting, but is not so suitable for the production of high-grade steel.

A typical example of the use of mains frequency is the coreless induction melting furnace which can be connected direct to the public 3-phase supply. Such a furnace rated at 120 kW, with a holding capacity of 2,240 lb., will give a throughput of 5,000 lb. per hour of hot cupola metal superheated from 1,350°C to 1,450°C.

Medium Frequency

Motor generators ranging from 10 kW to 1,500 kW or more at frequencies up to about 10,000 c.p.s. are widely used for heating for forging, melting from 100 lb. to 10 tons, hardening, annealing, etc. A bank of capacitors maintains a high power factor during the heating cycle.



Another form of generator for frequencies of 1 to 2 kc.p.s. and powers around 250 kW, useful for forge heating and melting high temperature aircraft alloys, is a 6-anode steel tank mercury arc inverter.

High Frequency

Metal hardening and metallurgical processing are best handled by high frequency induction (up to about 2,000,000 c.p.s.), particularly when a very thin case is required or when the section of the workpiece is too small to heat satisfactorily at medium frequency. These high frequencies are produced either by an electronic h.f. generator or a mercury-gap h.f. generator.

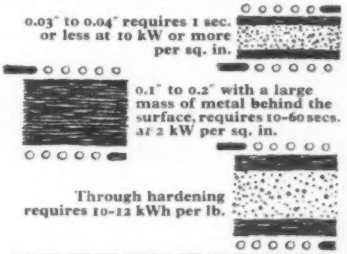
The choice of frequency depends upon the metallurgical requirements and the size of the component to be treated. The following table gives the practical relationship between size and frequency, and may be used as a guide to the choice of generator, subject to metallurgical considerations.

FREQUENCY C.P.S.	3,000	10,000	500,000	2,000,000
Optimum Values				
MIN. DEPTH OF HARDNESS POSSIBLE	.060"	.040"	.020"	.010"
Practical Values				
MIN. DEPTH HARDNESS EXPECTED	.150–.200"	.100–.150"	.030–.050"	.015–.030"
MIN. DIA. SURFACE HARDENING THIN CASE	2" & over	1" to 3"	½" to 2"	¼" to ½"
MIN. DIA. SURFACE HARDENING DEEP CASE	2" & over	2" & over	1" & over	not suitable
MIN. DIA. THROUGH HARDENING	1" & over	½" to 2"	¼" to ½"	not suitable

These are of course very approximate since they also depend on metallurgical considerations.

Power required for H.F. Induction Hardening

The high frequency power required per sq. in. of hardened surface depends upon the amount of metal behind the surface. Higher powers and shorter heating cycles are necessary for thin cases and when the thickness of metal behind the surface is small.



For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association. Excellent reference books (8/6, or 9/- post free) are available on electricity and productivity—"Induction & Dielectric Heating" is an example.

E.D.A. also have available on free loan a series of films on the industrial use of electricity. Ask for a catalogue.

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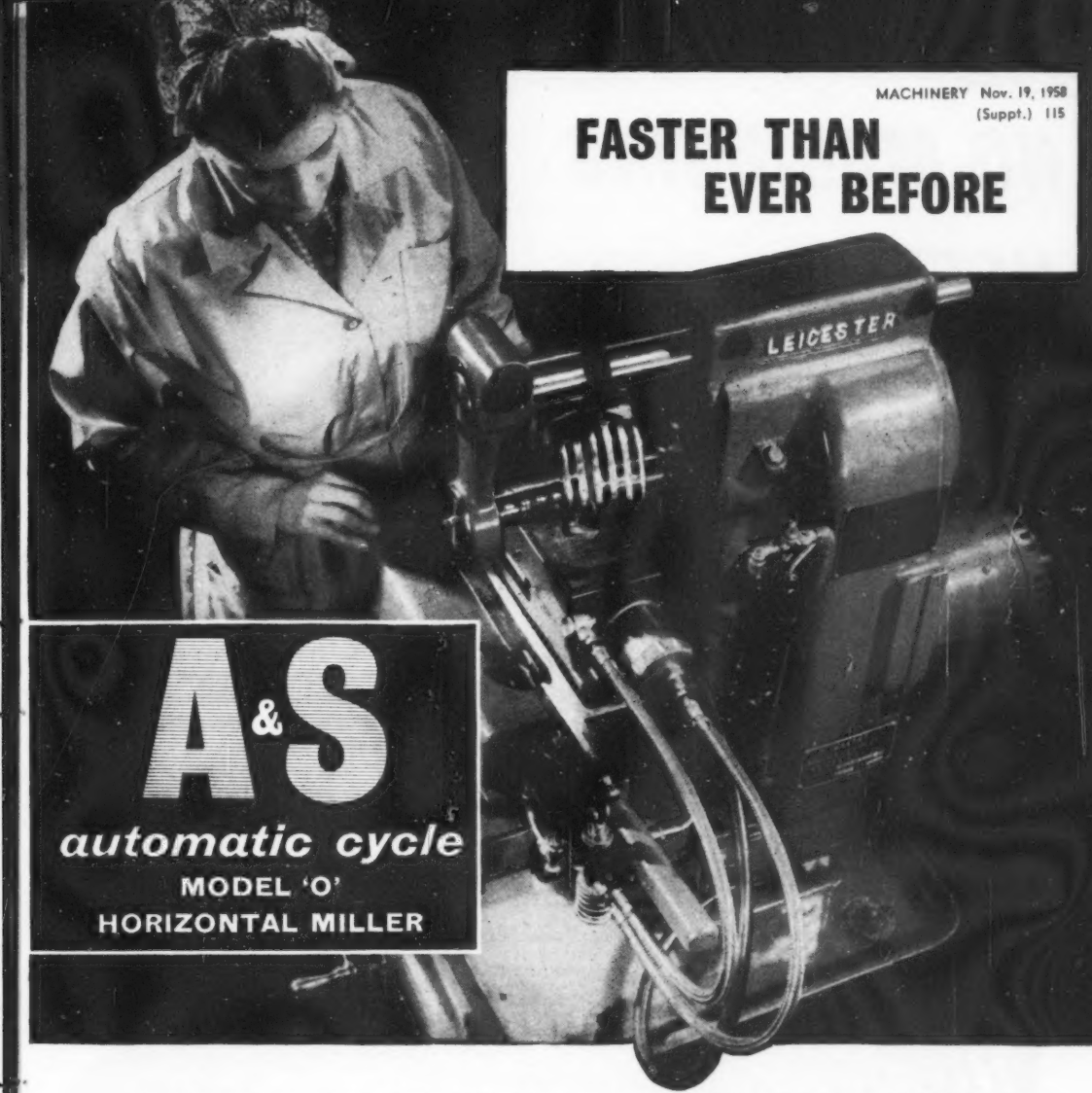

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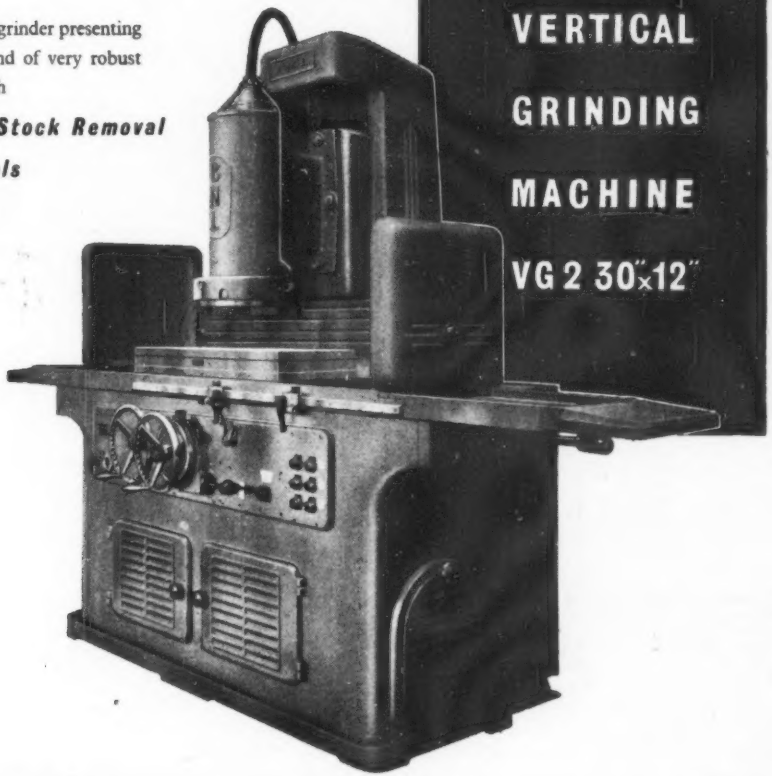

TABLE	working surface, length x width	30" x 12"
	longitudinal traverse	45"
	table speed	0-48 ft/min
	admits between table and wheel	12"
HEAD	vertical movement of wheelhead	13"
	speed of wheel	1420 r.p.m
	peripheral speed of wheel	4750 ft/min
	diameter of wheel	12"
	movement of head per revolution of handwheel	.050"

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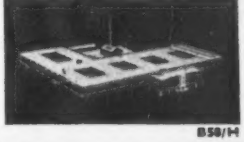

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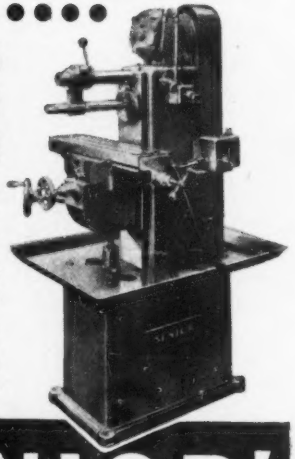

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- Table travel - 15in.
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- Vertical feed - 11in.

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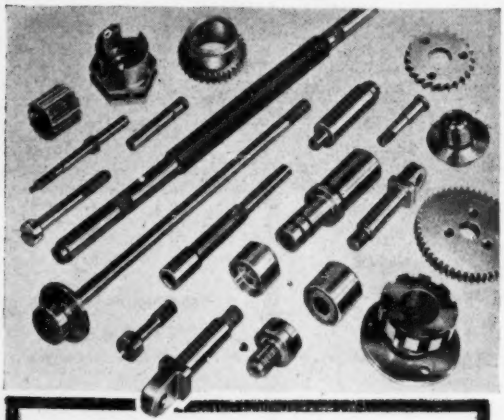

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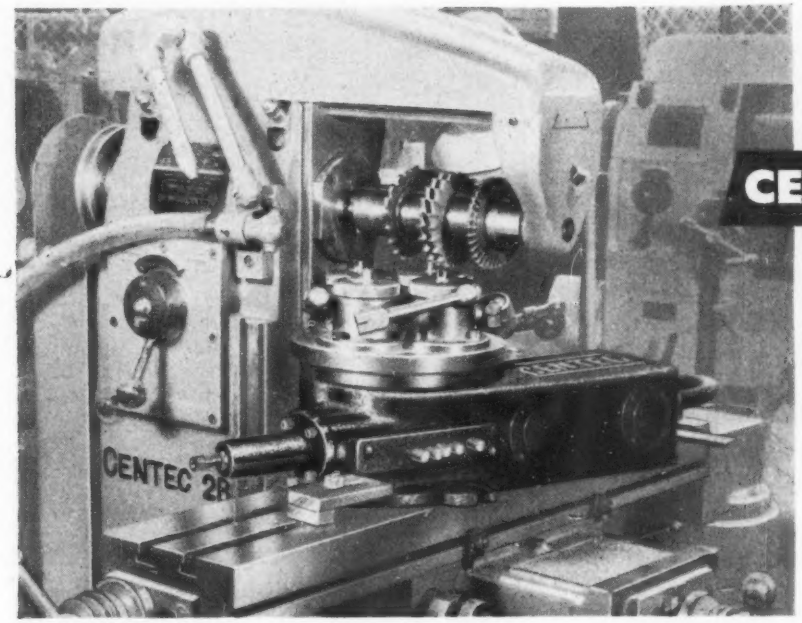

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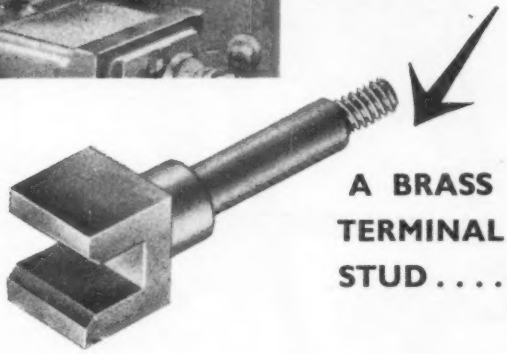
4 station index table

produces



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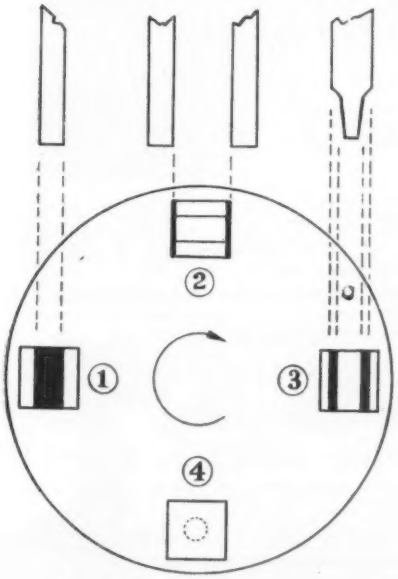

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2nd OPERATION

2. Straddle mill

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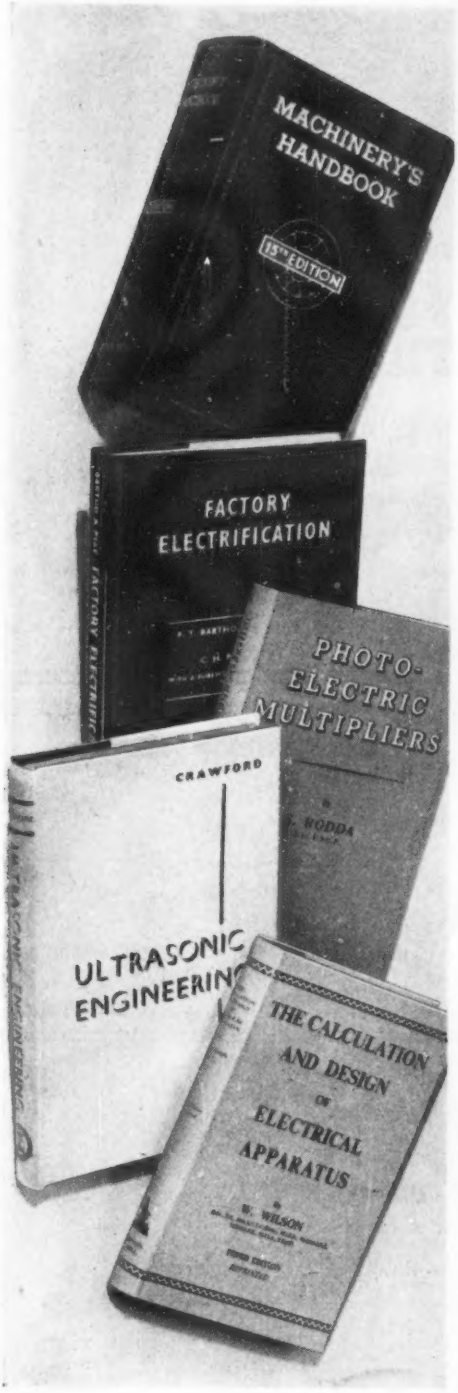

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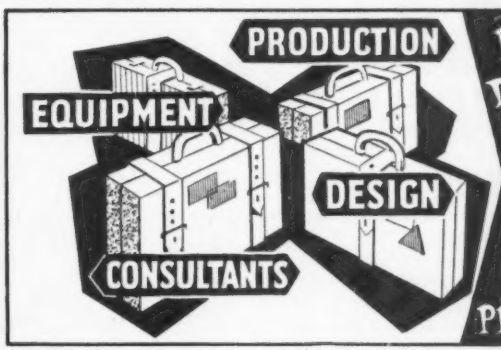

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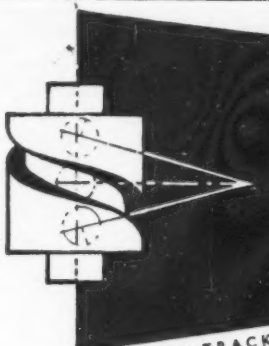

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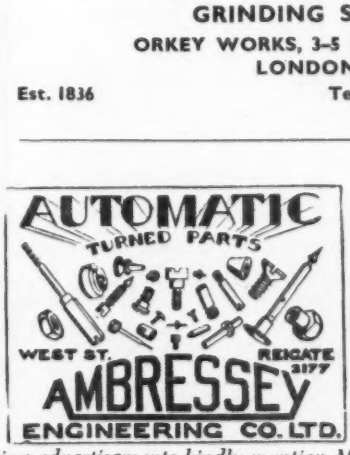

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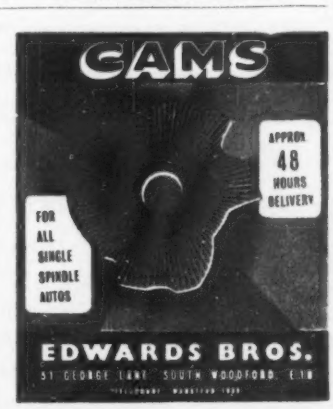

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Centreless Grinding Machine, No. 7 B.S.A. Max. capacity 3in. dia. Electrics 400/3/50. Excellent condition.—BOX Z746, MACHINERY, Clifton House, Euston Road, N.W.1.

"B.I.C." No. 131 Longitudinal Seam Welding Machine for sale. Specially suited for work which may be fed into the machine throat, side or straight seams on cylinders or drums. All electrical equipment suitable for 400 volts, 50 cycles. Maximum power required 12 kW. Two thicknesses of 20 s.w.g. Number of heating speeds 8. Depth of throat 24in.—Photo and details from F. J. EDWARDS, LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3.

Carl Unger 10in. by 30in. Universal Grinding Machine. Hydraulic. M/D. 400/3/50. With internal spindle.

CRAIG & DONALD 14ft. by 4in. Power Guillotine. Geared overcrank. M/D. 400/3/50.

TOWN 5ft. Radial Drilling Machine. No. 5 M.T. Low base. M/D. 400/3/50.

JONES & SHIPMAN 3-Spindle Drilling Machine. No. 3 M.T. spindle. Flange mounted motor. 400/3/50.

ALBERT EDWARDS (MACHINERY), LTD., 79/89, Pentonville Road, London, N.1. Telephone: TERminus 0167/8/9/

Several Plain Cylindrical Grinders for sale from 6in. by 18in. to 14in. by 18in. Churchill, Landis and Precimax.—Write stating size of interest, to BOX Z736, MACHINERY, Clifton House, Euston Road, N.W.1.

C.V.A. No. 8 Single Spindle Automatic Lathes, 2 machines Reconditioned in 1954 With third slide. £500 each to clear.—BOX Z669, MACHINERY, Clifton House, Euston Road, N.W.1.

Blacker Power Forging Hammer for sale. With fixed type arm and anvil. Motor driven for 400 volts, 3 phase, 50 cycles. Length of arm 20in. Stroke adjustable.—F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3.

Archdale 28in. Horizontal Miller with Vertical Attachment. 400/3/50.—HICKS MACHINERY, LTD., 26, Addison Place, London, W.11. Tel.: PARk 2333.

Classified Advertisements (*PLANT FOR SALE, contd.*)

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Telephone : CLErkenwell 6481

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DRUMMOND Model K, 1¼in. Bar feed.
HILLE R.H.15 ⅝in. Bar feed.
ACCURATOOL ⅝in. Bar feed.
WARNER & SWASEY No. 2, 1in. Bar feed.
HERBERT No. 7 Combination Turret.
ACME 5W Universal Turret, 2in. Bar feed.
LIBBY 4A, 2in. Bar feed.
MURAD ⅜in. Bar feed.
HAHN & KOLB RH25. 1in. bar. Unused.
SOUTHWARK No. 2. 1¼in. Bar feed.
DRILLS
ARCHDALE 21in. Production.
HERBERT Type B. Bench.
CORONA 13CX 2 Spindle No. 2 M.T.
ARCHDALE 5ft. Radial. 3in. cap.
JONES & SHIPMAN 2-sp., 15in., No. 2 M.T.
JONES & SHIPMAN 15in. Speed Drill-Max.
CORONA 12AX. ⅞in. cap.
BOLEY Cluster Type.
15in. HERBERT Type C, No. 3 M.T.
ENGRAVERS
T.M.A. Cutter Grinder.
ALEXANDER No. 1, 3 Dimensional.
T.M.A. Type G.3 and G.2.
LIENHARD Type 3R and 2.
T.T.H. Multi-Etcher.
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EDGWICK Filer.
RAPIDOR No. 1 Hacksaw.
WICKSTEED Cold Saw No. 1, 6in.
FOLDERS
BESCO 3ft. × 18 g. No. 5 Angle Bender.
KEETONA 4ft. × 14 g. Cramp.
GEAR CUTTERS
SYKES HV14 Hobber.
MAXICUT 7in. × 2in. × 6 D.P.
RAPIDAN No. 1½, 21in. dia. gears.
FELLOWS "Hourglass."
GRINDERS (Cylindrical)
TRUVOX 2½ × 18.
FRANCIS 6 × 7.
PRECIMAX MPB 10 × 48.
MYFORD MG12. New.
PRECIMAX MPH Plain. 10 × 24.
PRECIMAX U.P.J.-Universal. 12 × 48.
NORTON 6 × 18 Hyd. Type C.
NORTON 10×36. Type C.
GRINDERS (Tool)
UNION 14in. and 10in. As new.
GRINDERS (Miscellaneous)
ALBA Tool and Cutter.
LE BLOND No. 2. T. & C.
JONES & SHIPMAN 310. T. & C.
J. & S. 12in. × 24in. 305 T. & C.
JONES & SHIPMAN Carbide.
HERBERT HUNT No. 4 Drill.
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SNOW Table, 20in.
CHURCHILL OSB 40in. × 18in.
WRIGHT 8in. Table.
ROBOT 18 × 6.
SNOW P24, 24in. × 8in. Hyd.
ABWOOD 18 × 6 Vertical.
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SMART & BROWN.
SAACKE Model VII, Jig.
GUILLOTINE
KEETONA 4ft. × 14 g. Power.
HONERS
KITCHEN & WADE Hydraulic.
SUNNEN Type LB.
BARNES No. 2 Horiz.
KEYSEATER
CARTER & WRIGHT No. 2, 24in. × 1¼in.
LATHES
RIVETT 608 S.S. & S.C.
SMART & BROWN Type L. Sec. Op.
COULTHURST Surfacing and Boring.
EDWARDS 12in. Spinning.
WILLSON 7¼in. × 3ft. S.S. & S.C.
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DENHAM 5¼in. S.S. & S.C.
LE BLOND 11in. × 16in. Prod.
SOAG-OXFORD 6½in. × 24in. S.S. & S.C.
SOUTHBEND 9in. (Workshop), 14in.
LE BLOND Regal 10in. swing.
MILLERS (Horizontal)
CENTEC 2A US Multi Mills.
U.S. (Whitney Type) Production.
KEMPSMITH No. 1G.
BROWN & SHARPE No. 12 and 000 Prod.
CINCINNATI 08 and 1-18 Prod.
BROWN & SHARPE No. 2 Univ. Light.
SUNDSTRAND No. 00 Rigidmill. -
BURKE. Table 16 × 3½.
ARCHDALE 28in. Mfr.
CINCINNATI 3-24 Hyd. and 2 M.H.
HERBERT IS. Table 18in. × 8½in.
MILLERS (Vertical)
RICHMOND VHM. Table 26 × 8.
VICTORIA V2. Table 40 × 10.
ARCHDALE 30in. Table 48 × 12½.
HERBERT 15S. Table 50 × 10½.
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CANNING 5 h.p.
PRESSES (Power)
BLISS No. 8.
BESCO TVO Bench, 4 ton.
O. & S. 30 tons Straightening.
BESCO EB4, 40 tons. New.
TAYLOR & CHALLEN B2. 10 tons.
RHODES No. 19. 10 tons.
SCHULER VZZ, 15 tons d/s gripper feed.
RIVETERS
HIGHSPEED Hammer 4A. ⅞in.
ROTORIVET No. 5 Hammer.
TURNER ⅛in. RS2A Spinning.
SCREWING MACHINES
OSTER 1in.-6in. Pipes No. 326.
ATLAS No. 2, 3in.-6in. (Unused.)
SHAPERS
24in. ROCKFORD Hyd.
TAPPERS
HERBERT No. 2 Flash.
SUPERIOR ⅛in.
JONES No. 26. 2 B.A.-⅜in.
THIEL Nos. 3 and 4.
J. & S. Electrotap, ⅛in.
THREAD MILLERS
FACKS Plain, cap. 3in. × ⅞in.
REINECKER 8 × 72in.
LEES BRADNER Mod. 40. 6½in. H.M.
HANSON WHITNEY, 8in. × 40in.

Pollard 12AX 4-Spindle ⅝-in. capacity Drill, in good condition. Table 23in. by 10in. Fully motorised.—BOX Z762, MACHINERY, Clifton House, Euston Road, N.W.1.

C·E·M

ACME-GRIDLEY 4-spindle Bar Automatic, 3¼in.

WICKMAN 5-spindle Chucking Automatic, 5in.

MUIR 2½in. Travelling Spindle Horizontal Borer.

BIERNATZKI Gear Hobber, 27in. dia. max.

PROGRESS 4E Pillar Drill, new.

SEDGWICK 6ft. × ⅛in. Univ. Folder.

WARD 2A Capstan, bar feed.

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No. 3U "Adcock & Shipley" motorised all-geared Universal Milling Machine. Table 50in. by 12in., has longl. travel of 30in. Spindle speeds 20-1,400 r.p.m. Auto feed ⅛in.-50in. per min. all movements. Rapid traverse by separate motor. Good equipment. Post war machine.—LEE & HUNT, LTD., Crocus Street, Nottingham. Tel.: 84246.

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WARD No. 7 chucking capstan 1942. Machine in first-class condition.
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As New. **KERRY** 125 1½in. capacity pillar drilling machine, power feeds.
POLLARD six-spindle drilling machine No. 2 Morse taper.

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LEEDS 63-7398

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ACME GRIDLEY six-spindle Bar Auto, capacity 7/8in. With bar feed and other equipment. Screwing spindle. M.D. 400/3/50.

FARMER NORTON 4in. Centreless Bar Turning Machine. Suitable for 1in. to 4in. bars, with various cutter heads and other equipment. M.D. 400/3/50.

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BULLARD 36in. Vertical Borer. Swings 38in. 12 speeds 12 to 200 r.p.m. With side head. M.D. 440/3/50.

ASQUITH 3ft. 9in. Portable Universal Radial Drill. Built 1942. Spindle No. 4 M.T. Speeds 40 to 300 r.p.m. M.D. 400/3/50.

MINIMUS Gear Hobber. Will take blanks up to 2½in. dia. by 2½in. length. Design similar to Mikron 79. M.D. 400/3/50.

BALLINGER Model C.10 Abrasive Cutting-off Machine. Built 1951. Takes 16in. dia. wheels. Cuts 2in. solid M.S. bars. 3in. tubes. M.D. 400/3/50.

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CHURCHILL No. 1 Planetary Type Internal Grinder. Capacity with largest internal spindle 10in. dia. by 18in. length. Hydraulic operation with four internal grinding spindle, dust extraction unit, etc. Reconditioned.

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WARD No. 7 Capstan with covered bed. Speeds to 750 r.p.m. Air operated chuck. M.D. 400/3/50.

WARD 2A Capstan. Six speeds to 1,531 r.p.m. Collet cap 1½in. M.D. 400/3/50. Reconditioned.

CINCINNATI No. 4 Dial Type Universal Miller. Table 78½in. by 16½in. long traverse 42in. Quick power all ways. Dual controls. 21 speeds 18 to 1,300 r.p.m. With swivelling vertical head. Reconditioned. M.D. 400/3/50.

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AT ATTRACTIVE PRICES LONG BED AND HEAVY DUTY LATHES

30½in. **HARVEY** Long Bed S.S. & S.C. Lathe, motor drive, two saddles with rapid power traverse, swing over bed 61in., admits between centres 61ft.

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18in. **LE BLOND** Heavy Duty Geared Head Engine Lathe, size 32in., admits between centres 28ft.

18in. **LANG** S.S. & S.C. Lathe, motor drive one or two saddles, swing over bed 36in., swing over saddle 25in., admits between centres 12ft. 6in. Two available.

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14½in. **CRAVEN** S.S. & S.C. Lathe, motor drive, 2 saddles, swing over bed 29in., swing over carriages 20in., admits between centres 28ft.

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13½in. **LODGE & SHIPLEY** S.S. & S.C. Lathe vee bed, Norton gearbox, motor drive, swing over bed 27½in., swing over saddle 19in. admits between centres 14ft.

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HERBERT O Capstan. Bar feed and tooling.

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HOLBROOK 9in. Lathe. Taper turning etc.

PROGRES 20in. by 9ft. b.c. Gap Bed Lathe.

BROWN & SHARPE No. 2 Universal Grinder.

BIERNATZKI F.W. 2A Miller. Table 55in. by 14in.

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CRAIG & DONALD 10ft. by ¼in. Swing Beam Folder.

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KEARNS No. 3 Horizontal Borer.

THE MIDLAND MACHINE TOOL CO

BRADLEY, BILSTON, STAFFS. Bilston 42471/7

Classified Advertisements (*PLANT FOR SALE, contd.*)

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MITCHELL OF KEIGHLEY 10¼in. Gap Bed Lathe by 5ft. 5in. b.c. 400-440/7/50.

MITCHELL OF KEIGHLEY 12¼in. Gap Bed Lathe by 6ft. 9in. b.c. 400-440/3/50.

EXCEL No. 3/12 Hydraulic Horizontal Spindle Surface Grinding Machine. Capacity 24in. by 8in. Coolant equipment Motorised 400-440/3/50.

VICTORIA V2 Vertical Milling Machine. Spindle speeds 32-1,050 r.p.m. Table 45in. by 11in. Table traverse 29½in. 400-440/3/50.

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NORTON Horizontal Spindle Hydraulic Surface Grinding Machine, with hydraulic cross feed head. Capacity 48in. by 10in. Complete with D.C. magnetic chuck and generator. Coolant pump and fittings. 400-440/3/50.

HERBERT No. 4 Capstan Lathe, with draw-back collet, and power feed to turret slide. 400-440/3/50

NEWALL Type L 10in. by 24in. Plain Grinding Machine. 400-440/3/50.

LE BLOND A.G.H. S. & S. Lathe, 15in. dia. swing. 400-440/3/50.

HULLER No. 5 Vertical Tapping Machine. 400-440/3/50.

POLLARD 21A Single Spindle Vertical Production Drilling Machine.

ARCHDALE 18in. High Speed Vertical Milling Machine. Table size 38in. by 10in. Spindle speeds 79-2,000 r.p.m. 400-440/3/50.

DEAN, SMITH & GRACE 12in. Gap Bed Lathe by 3ft. 6in. b.c. 400-440/3/50.

BROWN & SHARPE No. 2 Light Plain Milling Machine, with dividing head, and universal vertical head. 400-440/3/50.

ARCHDALE 20in. Horizontal Plain Milling Machine, longitudinal feed 20in. 400-440/3/50.

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STOCK SOILED All Steel Press Brake of welded steel plate construction. Completely motorised for 400/3/50. Capacity 8ft. × ⅜in. Length of bed and ram 96in. Distance between side frames 69in. Stroke 3in. Treadle operated friction clutch.

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Photographs of the above are available.

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Taylor Challen B2 Press. Capacity 10 tons. Throat 6¼in. Daylight 8in. Adjustable stroke.—BOX Z786, MACHINERY, Clifton House, Euston Road, N.W.1.

Nearly New, 1,000 Ton Eumuco Coining and Sizing Press, 2in. stroke, 31in. between sides. Air operated clutch and brake, with 40 h.p. motor drive. Heavy steel plate construction.

160 ton Hordern, Mason & Edwards High Speed Friction Screw Press, type 4SP, 13in. effective stroke. 21in. tool space. 6¼in. dia. screw. 10 h.p. motor drive.

REED BROTHERS (ENGINEERING), LTD., Replant Works, Woolwich Industrial Estate, London, S.E.18. Telephone: Woolwich 7611/6.

Herbert 2D Capstan Lathe. Just reconditioned. 1¼in. dia. capacity.—BOX Z777, MACHINERY, Clifton House, Euston Road, N.W.1.

Taylor & Challen B3½ Geared Press, 60 tons, 3in. stroke. Fitted 9in. double roll feed. Mot.—WILCOX & CO., Barr Street, Birmingham, 19. NORthern 1234/5.

New Britain-Gridley No. 60 1in. capacity Six Spindle Bar Automatic.
Petermann P7, ⅞in. capacity Sliding Head Single Spindle Automatics.
Petermann No. 2 Pinion and Gear Cutting Machines.
Herbert No. 6 Chucking Automatic.
Coventry Gauge and Tool Gap Gauge Grinder.
Newall 6in. × 18in. Hydraulic Plain Cylindrical Grinder.
B.S.A.-Landis 6in. × 18in. Type C Hydraulic Plain Cylindrical Grinder.
Brown & Sharpe No. 5 3in. × 18in. Hydraulic Plain Cylindrical Grinder.
Heald No. 73 Hydraulic Centreless Internal Grinder.
Bryant 16-28 Hydraulic Internal Grinder.
All of the above are modern machines, in first class condition, motorised for 400-440/3/50 A.C. electric supply and are offered at genuine bargain prices.
THE WEST MIDLAND EQUIPMENT CO., 10, Hagley Road, Stourbridge, Worcs. Stourbridge 4187.

Rhodes No. 146 Combined Drum Flanging and Double Seaming Machine for round drums for sale. The drums revolve. Capacity up to 14in. diameter × 24in. high. Maximum thickness, 22 s.w.g. Treadle friction clutch. Weight about 30 cwt.—Photo, etc., from F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3.

Lorenz Gear Shaper, Model S.O.O. Capacity 7¼in. P.D. × 2in. face. Motorised.—WILCOX & CO., Barr Street, Birmingham, 19. NORthern 1234/5.

Two Edgwick Fully Automatic Face Cutter Grinders, for cutters 4in. to 20in. diameter. Also some types of side cutters. —BOX Z703, MACHINERY, Clifton House, Euston Road, N.W.1.

Avery Electrodynamic Balancing Machine, type 726, capacity 3ozs.-20lbs. Almost new. £420.—BOX Z704, MACHINERY, Clifton House, Euston Road, N.W.1.

500 Ton Double Action Drawing Press, blankholder 60in. × 60in. with self-contained Oil Pump Unit.
REED BROTHERS (ENGINEERING), LTD., Plant Works, Woolwich Industrial Estate, London, S.E.18. Telephone: Woolwich 7611/6.

Pollard Corona 4-Spindle Drill, 8 spindle speeds to 1,465 r.p.m., with pole change motors and geared heads. No. 3 M.T. —BOX Z791, MACHINERY, Clifton House, Euston Road, N.W.1.

Snow Hydraulic Surface Grinder, Table 32in. × 8in. Auto. feeds. Horizontal Spindle. Mot.—WILCOX & CO., Barr Street, Birmingham, 19. Northern 1234/5.

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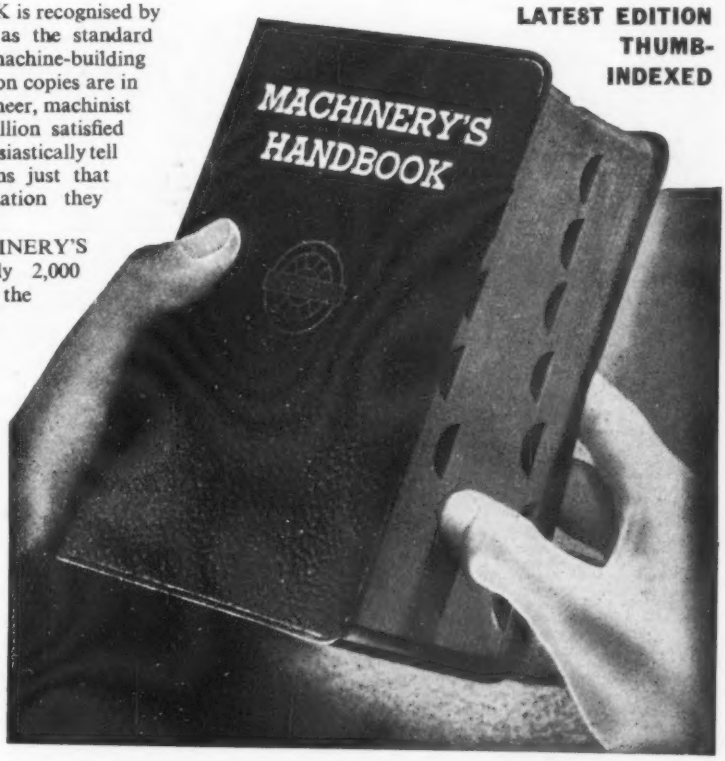

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Messrs. Winch, Greensted & Winch, Solicitors, 6 Park Road, Sittingbourne, Kent; of

Messrs. Rule & Rule, Surveyors and Auctioneers, 37/39 Broadway, Sheerness, Kent (Sheerness 2604); and of

Messrs. Henry Butcher & Co., Auctioneers, Valuers and Surveyors, 73 Chancery Lane, London, W.C.2. Holborn 8411 (8 lines).

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D.S.I.R. Require Assistant Experimental Officer at Hydraulics Research Station, Wallingford, Berks, Engineering Services Section, which is responsible for purchase of materials and equipment, control of workshops, stores, transport and site services. Candidates should have an engineering training and workshop experience. Qualifications: G.C.E. "A" level in two Science or Maths. subjects or equivalent. Over age 22, H.N.C., pass degree, or equivalent generally expected. Salary range: £370 (age 18)-£645 (26)-£800. Five day week.—Forms from M.L. & N.S. TECHNICAL AND SCIENTIFIC REGISTER, 26, King Street, London, S.W.1, quoting C713/8A. Closing date 28th November, 1958

Interesting Overseas Opportunity offered to first class toolmaker experienced in pressure die moulds and press tools. Two year contract with reputable Indian Company in Calcutta.—Write full details BOX Z692, MACHINERY, Clifton House, Euston Road, N.W.1.

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Applicant must have Trade Shop experience and be used to high class manufacture of jigs, Press Tools, Moulds and Die Casting Dies.

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Free Lance Agencies Required in the South West area, for small machine tools and allied products, e.g. Files, Spanners, Twist Drills, and Gauges, as used in general engineering.—BOX Z698, MACHINERY, Clifton House, Euston Road, N.W.1.

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Wanted, Secondhand Herbert Chipstream Roller Boxes for 2D and No. 4 Capstans.—Apply R. T. THORPE, LTD., Brent Way, Brentford.

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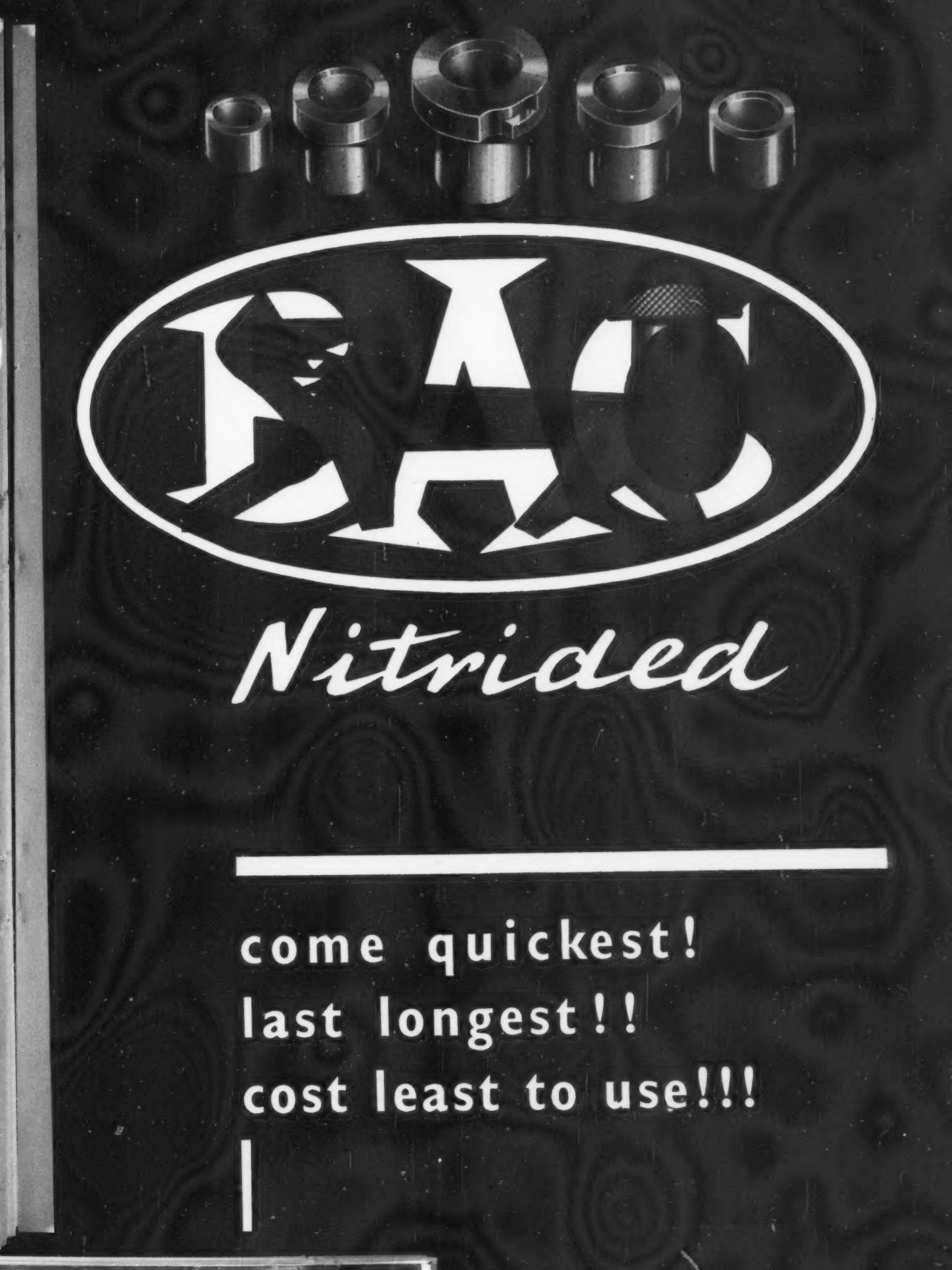
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